

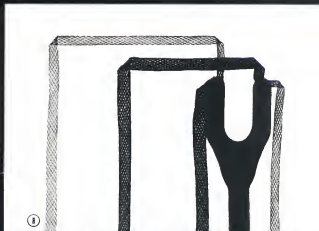
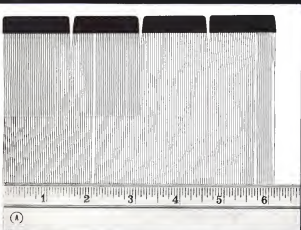
AVIATION WEEK

SEPT. 12, 1955

50 CENTS

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Now! Two types of rubber blankets



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Two types of electrothermal rubber — spearheads of the success of Iceguards by Goodyear, in protecting aircraft from icing dangers—are now available for many other uses where there is need for "flexible," foolproof heat sheathing.

"Heated Rubber" can be tailored to fit surfaces of any size or shape. Its success when applied to external surfaces of airplanes — such as propellers, wings, air scoops, intakes and antennas—gives assurance of wider utility for hydraulic heaters, battery blankets, conductive wiring, heating jackets for mechanical equipment of all kinds, on the ground or in the air.

Goodyear Engineers can help you engineer the answer to your heating problems, including complete control equipment. For full information, write: Goodyear, Aviation Products Division, Akron 16, Ohio or Los Angeles 54, California.



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WIGGINS COUPLINGS SAVE 49 POUNDS ON CONVAIR F-102

The new CONVAIR F-102 is 40 pounds lighter because WIG-O-FLEX Couplings replaced standard AN connectors and cut lines. We are grateful that engineers at CONVAIR—the company that guides itself in Engineering to the 10th power—chose WIG-O-FLEX Couplings for a place where weight was a major problem. The WIG-O-FLEX Coupling weighs 1.5 as much as the standard AN connector it can replace. (See weight chart for exact comparisons.)

WIG-O-FLEX COUPLING



flexible union for connecting
rigid tubes



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Domestic

Fedtek jet target drone probably will be built and sold in the United States by East Coast Aerospace, Inc., under license from Australian government. The U.S. firm already has signed the end of the contract. But Australia's success in Washington signaled last week that their government has not yet approved the agreement. Further, prospective sales will be Australia to send East Coast a quantity of the electronically guided, piston aircraft for evaluation. Aerospace flies developed in the Australian company, is expected to find wide use in coordination of the drone and navy exercises, its performance.

Seven-day strike at 20,000 production workers against Bendix Aviation Corp. was settled Sept. 4. The new contract between Bendix and the United Auto Workers (UAW) guarantees employees 60 to 65% of their regular take-home pay during layoffs, including stock, pension, profit-sharing, for up to 36 weeks. The agreement also provides for wage increases of up to six cents an hour and various other fringe benefits.

Twelve Convair 440s were ordered by Sabena Belgian Airlines, bringing the total number of Metropolitan sold in air to 31 (AW Sept. 5, p. 40). Sabena's Westcott contract calls for 14-passenger transports, with reasonable flexibility to permit conversion to the 12-seat configuration. Convair President Joseph T. McNamara says other U.S., European and Latin American Metropolitan orders are now under negotiation.

The name Tacon stands for tactical air communication and navigation. Not merely tactical air navigation. The system is expected to be capable of providing air-to-ground and ground-to-air data transmission (this link) and possibly voice communication through pulsed modulation.

Post & Whitman Aircraft plans to double the production rate of its North Haven, Conn., plant. The on-site building reports the address—500,000 sq. ft. of production floor space and 100,000 sq. ft. of office floor space—will be ready for occupancy by about mid-1978.

Finchfield Engines & Auxiliary Corp.'s Engine Division received new sub-contract orders totaling more than



Canway Jet Starts Tests

Rolls-Royce Canway jet-piston engine makes its first flight in the Canway Ashton testbed aircraft. The 11,000 lb thrust British turbojet powerplant is mounted as a pod under the high-altitude research plane's fuselage. The jet and its testbed appeared at Britain's SBAC aircraft show in Farnborough last week (see p. 12).

\$4.2 million during August. The contracts were for large powerplant components—including turbine wheels, front and rear engine frames and exhaust nozzles.

State-owned, rather, manufactured by Radio Corporation of America, will be installed on four Douglas DC-7Cs ordered by Swissair. The transports will be delivered to the Swiss airline in 1978.

Booth Aircraft Corp. has started deliveries on a \$750,000 subcontract with Lockheed Aircraft Corp. for wings for the T-119 Navy jet trainer. Production at Bethesda's Liberal and Wichita Divisions will extend well into 1978.

Financial

Carbo-Wright Corp., declared quarterly dividends of 40 cents on common shares and 50 cents on Class A stock, both payable Sept. 15 to holders of record Sept. 7.

International

Monroe-Sunder NS 760 was scheduled to start tests by the Royal Canadian Air Force last week at Kitchener. A team of RCAF headquarters and training officers earlier had made preliminary evaluation of the jet trainer at Booth Aircraft Corp.'s Wichita plant. Booth holds an option from Monroe-Sunder on rights to manufacture and sell the NS 760 in North America.

Dezner DO-2T, first piston plane built by the German aviation company, made its first flight at Oberpfaffenhofen near Munich. The single-engine, two-glider aircraft was constructed in Spain by Dezner engineers and technicians and shipped to Germany for test flights.

Canadair Ltd. and its affiliate, Orenda Engines Ltd., are negotiating a sales agreement with the Venezuelan government for Canadair-built F-4B Sabers. Exports to Venezuela would be the first to a country outside the North Atlantic Treaty Organization for the Canadair fighter and its Orenda turbojet powerplant.

Four Martin B-57s arrived in Japan last week and will be used by the U.S. Air Force for bomber crew training. The last four jet bombers made the 2,410-mile trans-Pacific flight from the U.S. in 5 hr. 45 min.

New international airport will be constructed by the Canadian government near Edmonton, Alta. The field will have at least two 10,000-foot runways. It will be used by Northwest Orient Airlines on flights to Alaska and the Far East.

Locks Aeris Contaminator is being formed in Puerto Rico to provide regional air service in Central America. The airline will start operations Dec. 1 with Convair 440s, flying between the cities of San Juan and San Jose.

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Only in Proto plastic-handle screwdrivers do you get handles shaped to fit your hand. They have a large palm diameter, a smaller diameter for little finger, deep top, thumb and forefinger thrust grooves, deep flats and smooth lines. Durable, too, are Proto's popular wood-handle screwdrivers, noted for their power-grip handle and steel tip. For screwdrivers that give you more drive, use your Proto drive. Send for the catalog of entire line.

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AVIATION CALENDAR

- Sept. 17-Institute of Radio Engineers, Inc. presents an Automatic Color Reproduction Conference, Los Angeles.
- Sept. 17-18-Int'l. Airplane Ass'n. Convention and Exhib., Ottawa, Canada.
- Sept. 17-18-American Rocket Society Western Fall Meeting, Los Angeles.
- Sept. 21-22-International Association of Aeronautical Engineers, sponsored by Pratt & Whitney and General Motors, Hotel Tuller.
- Sept. 21-22-American Helicopter Society, Western Coast Forum, Hollywood Boulevard Hotel, Hollywood, Calif.
- Sept. 26-28-American Institute of Electrical Engineers and Institute of Radio Engineers, Fall Symposium, Detroit.
- Sept. 29-30-Radio Electronic Convention for Scientists and Engineers, Seattle, Wash., Washington, D.C.
- Oct. 1-3-Electrical National Electronics Conference, Hotel Sheraton, Chicago.
- Oct. 4-6-National Annual Aircraft Sports Meeting and Exposition, sponsored by Chrysler Corp., Long Beach, California.
- Oct. 5-7-National Business Aircraft Association annual Meeting and Forum, Sheraton-Congress Hotel, Detroit.
- Oct. 5-7-1951 National Airport Conference sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.
- Oct. 9-10-World Physics Day and Exposition, National Guard Armory, Los Angeles.
- Oct. 10-Symposium on High Performance Aircraft Systems, sponsored by Institute of Transportation and Traffic Engineering, AAS, University of the Southern California, Los Angeles.
- Oct. 11-14-National Association of Radio Aeronautics annual convention, Dallas.
- Oct. 14-15-Society of Automotive Engineers, Golden Anniversary Automotive Meeting, Aeronautical Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.
- Oct. 16-19-Southern Internal Aircraft Design and Engineering Conference, sponsored by the Washington State Aeronautical Council and the State College of Washington, Wenatchee, Wash.
- Oct. 17-18-National Air Council, 50th National Congress and Exposition, Los Angeles and General Motors, Long Beach.
- Oct. 17-18-International Air Transport Association annual meeting, Long Beach.
- Oct. 19-20-International Air Transport Association annual meeting, Long Beach.
- Oct. 20-21-Southern Airport Managers' annual meeting, Greenville, S.C.
- Oct. 21-22-American Institute of Radio Engineers, 1951 Fall Joint Convention on Aeronautical and Navigational Electronics, Bell Telephone Hotel, Baltimore.

PICTURE CREDITS

12, 14-NOEL; 11-Harold G. Smith.

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WHO'S WHERE

In the Front Office

Felix G. Mordell, chief executive of Eastern European Aeronautics, will resign Oct. 15 to become managing director of British Aircraft Ltd., a new firm being formed by British Aerospace Co.

Adm. Robert E. Cassey (USN Ret.), head of direction of the Fairchild Engine and Turbine Corp. Cassey was formerly Chief of Naval Operations member of the joint Chiefs of Staff and Commander of NATO forces.

Adm. J. M. Cassey, engineering consultant vice president and general manager of Bell Helicopter Corp., Los Angeles, Cal.

A. E. Van Cleave, vice president, Bureau Steel Corp., Van Cleave formerly was vice president of Grinnell Metal Company.

C. Allen Day, vice president and secretary of ACP Industries.

Donald F. Marek, vice president of the Martin-Denham, Ohio Ordnance Chemical Corp. Other changes: E. W. Sherrill, sales manager for Jetco products, St. Louis, Mo.; vice manager for Jetco product.

R. S. Smedley, F. chairman of the board, Eastern Air Lines, Detroit, Mich.

George G. Lane, assistant vice president of the piston division, Napco Chemical Co. Ret. Adm. Arthur S. Ross (USN, Ret.) returned to the top government research and development, Collins Radio Co.

Clyde F. Bennett, aeronautics director, California Aeronautics Commission.

John E. O'Neil, assistant secretary to the director, Carroll Aeronautical Laboratory. Other changes: John C. Kane, personnel manager; Alvin E. Green, assistant manager.

John W. Brown, vice president to the president, All-Jet Aircraft Instrument Co.

Ernest F. C. Wilcox, member of the board, Decca Radio Co. (Canada) Ltd., Toronto. Wilcox is president of Canadian Helicopters, Ltd. and South-West State Ltd. and executive vice president of Dupont Canada Ltd.

Changes

As Vice-Minister Joseph Cox, Senior Air Staff Officer, Flying Training Command, Air Ministry, London, England.

J. E. F. Denning, Director of Engine Research and Development, E. Manley of Smith, England, is promoted. R. G. Frensch, Director of General Weapons Production, is J. Lee, Director of Scientific Research on Guided Weapons.

Frederick H. Dumas, Jr., chief of projects and business for Nuclear Energy Dept. of National Research Corp. Writer J. Harbison proposed atomic energy and public relations director, DuPont Helicopters Inc.

J. Paul Riney, control director of aircraft development, Washington TWA of Inc.

Robert Cassey resigned as assistant to the president of Fairchild Engines to accept a position with Lockheed Aircraft Co. (Continued on page 111)

INDUSTRY OBSERVER

(Editor's Note: This column was prepared by a team of Aviation Week editors who attended the National Aircraft Show in Philadelphia Pa.)

►New model of the Hughes Aircraft Helicopter GAR-56 airframe model will be about 5 ft heavier than the present model, and the fuselage will be lengthened. Present model weighs about 112 lb. USAF is considering plans to equip day fighters with the Helix.

►Cause of the N-1A explosion (AW Aug. 15, p. 17) may have been due to failure of seals on the liquid oxygen tank.

►Alfred F. Anderson, engineers' group, Bureau's assistant in aircraft in Washington who was an authorized operator at the National Aircraft Show, has 3,750 flight test hours.

►Major modification of the P-51 Mustang, present piston-powered version of the 40-engine Transporter, will be replacement of the V-12 engine with a turboprop. It is possible that the fuselage will be lengthened to keep the fuel and oil tanks from hitting each other.

►Indication of the Douglas A-1D's new flight landing characteristics is the plane's ability to fly in a level attitude at 90-95 knots at about any angle.

►New Westinghouse TD-31, 6,000-hp. diesel piston engine (aircraft) will be flying next spring on a B-47 testbed. A test version of the engine already has undergone a 70-hr. trial, and the complete version reportedly has been tested successfully at sustained altitude of 95,000 ft. The TD-31's single compressor has 15 stages and uses an airfoil pattern similar to that of a known-and-known-to-Beaumont. Westinghouse has license and information interchange agreements with Rolls-Royce. Engine also features two power boxes for accessories, a small area under the inlet which is connected by a duct to a larger one under the compressor front section of the powerplant.

►Michael Skowalek, president and chief engineer of Skowalek Aircraft Corp., W. Trenton, N. J., will be in charge of a new transport that is larger than the Cessna 441. He also has a small transport design in work.

►Among the simplified equipment installed in the lightweight Douglas A-119A Skyhawk is a single-engine instrument which displays all of the important information on the Wright 365, including speed for the pilot to see several dials.

►Cessna's F107-1 Tiger superlight fighter is reported to be suffering from suffering at comparatively low speeds.

►Industry sources report that USAF fighter designations have gone as high as F-115.

►Bell Aircraft's jet VTOL has made several transitions from vertical to horizontal flight.

►Pittsburgh Helicopter Corp. has entered subcontracting on the H-21 from 70 to 150.

►Most of airframe reflecting three hours installed on new Boeing KC-119 jet tankers will be retained on the plane's tail, providing much closer aerial support than present boom on KC-97 Stratofreighters.

►North American F-100Cs in the Douglas Trophy race-carrier race carried 4,770 gal. of fuel. Plans now call for an additional 230 gal. in each of two underwing auxiliary tanks. Super Sabre in the race didn't carry the drop tanks. Replacement of leaking chutes at fueling stage took approximately 90 seconds.



You CAN Afford Travel Safety

Aunt Mehitabel's ideas about "flying machines" are as outmoded as her hats

Modern personal and executive airplanes have a safety record that is superior to that of motor cars by a ratio of about five to one.

No one who has experienced the pleasure of flying straight to his destination in a BEECHCRAFT at a speed of from 180 to 215 miles per hour will be content to fight traffic at 40 or 50 miles per hour on the ground, around devious routes.

The cost of a Bonanza is greater than a top-grade car, but it delivers more miles per gallon, and owners often depreciate it over 500,000 miles of use. If usage is reasonably high, the cost per mile is very little more than that of a fine motor car.

You really can afford travel safety. For complete details, see your BEECHCRAFT dealer or distributor, or write to Beech Aircraft Corporation, Wichita, Kansas.



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Washington Roundup

Politics and Air Power

Political interference with planned Fiscal 1956 expenditures for national defense last week worried the U.S. Air Force, but informed Pentagon observers believed the threat could be lessened.

Reports that the Defense Department had been ordered to slash about \$1 billion from its Fiscal 1956 expenditures (AW Sept. 5, p. 11) were couched in minor language. A Defense spokesman said no top limit had been set but "certain" not being held to explore the possibility of getting the overall department expenditure down to \$31 billion. To do this, it was indicated, USAF would have to slash about \$770 million of the reduction.

Political angles of the situation held topmost interest. Goal of a balanced Fiscal 1956 budget is the prime concern, not of the White House itself, but of the GOP advisors, who feel they need it as a frame of reference in case President Eisenhower decides not to run for another term.

The White House from a balanced budget but not at the expense of weakened national defense. The strangle hold is that a substantial part of the American people, shocked by Russia's air power demonstration in May and first reported by Aviation Week (May 13, p. 12), prefer a strong USAF to a balanced budget.

The internal political conflict, if it develops, will be between Treasury Secretary George Humphrey, who is strongly conscious of political problems, and Defense Secretary Charles E. Wilson, who has gone before Congress as recently as mid-June to seek more money to accelerate B-52 production. Deacceleration at this time would be tantamount to the Louis Johnson "stretch-out" before the dawn of Korea, a program that was held to Johnson's career and reputation.

Close as Wilson has been to Humphrey, the Defense chief in recent months has, of his own admission, learned much about the importance of Congressmen. Top threat here is Sen. Stuart Symington, Missouri Democrat, and former Secretary of the Air Force. Wilson knows that any threat to air power will reflect back to a devastating attack on Capitol Hill. Only unknown question: will the Democrats open fire at once when and if vote are made, or allow their guns like the polished campaign to "smoke out"?

USAF Secretary Donald A. Quarles paid a flying visit to Wilson at a Michigan vacation spot to discuss the situation. Presumably, he carried with him details of where USAF would have to cut if the GOP report is met.

Less than a week before Quarles was hooked on this subject in a two-day session with his top financial and procurement advisors.

At this Pentagon, it was reported that Quarles "will not survive until he knows he has been hurt" but it was clear that he is "ready to accept it necessary."

USAF's physical cut for expenditures of about \$5 billion for aircraft in Fiscal 1956. There is no doubt that the politically minded, economy advocate would like to reduce this figure.

While Secretary Quarles withheld comment, he gave a clue to his attitude in a speech at Philadelphia before the foreign air attachés.

He said "President Eisenhower is leading every effort of his Administration toward achieving a proper balance between the requirements of national progress

and the long range requirements of national security and welfare. . . .

"We are proceeding on the assumption . . . that the American people want an Air Force strong enough to accomplish its mission. . . . Our objective must be to get the most value for the dollars we spend. This means not only that we must continue to practice good management within the Air Force, but also more important, that we maintain a steady program which will give the aircraft and electronics industries which serve as an opportunity to provide the equipment we need on an orderly basis without costly crash expenditures or sharp cutbacks."

New CAB Atmosphere

Recent Civil Aeronautics Board handling of major airline cases gives evidence of the shift in its approach to route regulation. Action of the Board in the New York-Chicago case (see p. 11) and of comments in the Northwest-Southwest and Denver Service Cases, shows a trend toward a gradual overhaul of the present regulatory system structure. With the Big Four continuing to expand its dominance, CAB appears inclined to strengthen this smaller body in their various moves to improve their economic position and make them more effective competitors.

Capital Airlines and Northwest Airlines became the first beneficiaries of the new atmosphere with substantial gains from the New York-Chicago decision. Adjustments in Capital's routes are an outcome that they approach the value of new route awards and will result in a substantially stronger route structure for the regional carrier.

Shakeup in Navy?

With the major shakeup in Navy public information soon after Rear Adm. Edgar W. Fox takes over. His successor, Adm. Arthur Burke, now Chief of Naval Operations, is deeply conscious of present and past weaknesses and is determined to remedy them. Harold a victim of Navy policy in the days when Op-28, which should have been explained to the public, was kept secret and therefore sinister, Adm. Burke is not without experience in the damage that can be done by stupidity in public relations. An avowed spectator at the National Aircraft Show, Adm. Burke had an opportunity to see his present publicists in action. Recent visit to the Navy JFO setup in Philadelphia was Cmdr. Cook Cleland, 1947 and 1949 winner of the Thompson Trophy, who is back in service, and the best-informed Navy PIO in the show.

Surface Mail By Air

General Accounting Office has completed its study showing that Post Office Department's experiments in the shipment of surface mail by air have been profitable operations. Sen. Styles Bridges (R-N.H.), though, has ordered a study.

Meanwhile, the staff of House Post Office Committee is making a study of the pros and cons of permanently authorizing the shipment of regular and other airmail. This would require legislation. Vincent Burke, Deputy Postmaster General in the Truman Administration, has been retained in a consulting consultant.

—Washington staff



RICHARD WHITCOMB, who discovered the area rule concept, with one of the wing-body combination models that resulted in many

NACA Formula Eases Supersonic Flight

By David A. Anderson

Washington—A revolutionary concept in supersonic aircraft design that is increasing speeds of U. S. military aircraft by as much as 25% was revealed today by the National Advisory Committee for Aeronautics.

Known as the area rule and developed by Richard T. Whitcomb of NACA's Langley Aeronautical Laboratory, this concept reduces the once-complicated procedure for determining maximum aircraft drag coefficients to a simple graphical procedure.

The NACA area rule has been demonstrated in supersonic flight testing of the following new fighters:

• Convair F-102A Delta all-weather interceptor now in production for USAF at Fort Worth.

• Convair F-102B (now-based interceptor) now in production for the Navy at Bethesda and Forrest River, Long Island.

• Chance Vought F8U-3 carrier-based

interceptor scheduled to go into production soon at Dallas, Tex.

The area rule was discovered by Whitcomb and his co-workers at the NACA Langley laboratory in 1941 at Langley Field during 1939 and later verified by wind-tunnel model tests at NACA's Pieterbush Aircraft Research Station at Wallops Island, Va. Area

rule data was made available to the service airlines in 1952 on a secret basis. The first prototype aircraft incorporating it flew during 1954. Area rule data was kept under tight military security until, about early 53 months after American Wars first tested of the concept.

Whitcomb's concept says that the



MODEL of hypersonic plane using area rule to compensate for interference drag.

Area Rule and Coke Bottle

It's unfortunate that the phrase "Coke bottle" was given to the fuselage shape derived from the Whitcomb area rule, because the two are not the same.

During World War 2, the German aerodynamicist Kuchemann made flow studies over the wing root of a swept-back wing and fuselage combination. He found that the flow tended to follow the fuselage, then turned out again. He reasoned that the interference of wing and fuselage at the root would be reduced if the fuselage were contoured to match the flow.

American investigators later discovered the development and named it with the name of "Kuchemann's Coke-bottle."

As far as is known, Kuchemann did not extend his idea to any other wing form than the swept, Whitcomb's area rule applies to any general shape. While the two applications as a swept wing can look alike, in reality they differ because Kuchemann's is related to the local circulation of flow and Whitcomb's is concerned to smooth an area where there is a sharp bend in the cubic stress tube.

ally the interference drag—the major drag component at transonic speed—depends almost entirely on the distribution of the airplane's total cross-sectional area along the direction of flight. Interference drag is caused by the interaction of wings, fuselage, tail and other airplane components. To combat this, Whitcomb found that the lowest drag in the transonic range was recorded for a theoretically optimum body of revolution—a streamlined shape that resembles a bullet without fins. The next step was the discovery that wing in the speed range decreased in proportion to how slowly the cross-sectional area of a winged body resembled that of the optimum body of revolution.

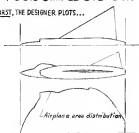
The last steps in developing a design is applying the area rule to a new aircraft.

First, the designer plots the cross-sectional area of the first layout against the aircraft length.

Second, he compares the shape of these curves with the area distributions for an "ideal" shaped body of revolution. The "ideal" shapes have been derived mathematically, and reveal NACA's Tenthredine (TN-147). On Busted Bodies of Revolution Having Maximum Wave Drag. In: Keith G. Bunker and Conrad Kuchemann, Jr., LMAI, goes into specific shapes. The drawings of fuselage cross-sections, based by design considerations. Kuchemann's Tiger was lengthened by correct elevator deflection, its diameter of the Tiger was determined by size of the

FOUR SIMPLE STEPS ...

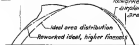
FIRST, THE DESIGNER PLOTS...



SECOND, HE COMPARES...



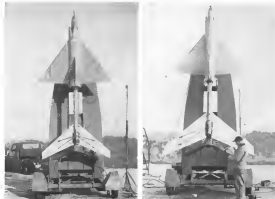
THIRD, HE REWORKS...



FOURTH, HE CONVERTS



Aviation Week



CONVAIR F-102 model (left) in its original aerodynamic form ready for benching. Modified version (right) showing how nose cone

Wingheight 161 inchtop.

•Third, he reworks the airplane area distribution until it again is closely as predictable with the "ideal" shape. Components may be forced by such factors as visibility requirements from the cockpit, or provision for addition of an airbrake at some later date.

•Fourth, he converts the new area distribution plot back to airplane cross-sections, determining wing, tail and other component area from the large cross-section at each station. That most variation may be made by a smooth change in fuselage radius, or it may be made by local changes on the fuselage side in the Tiger.

The result is a continuous layout for minimum transonic drag.

The final shape can show the obvious indentation of the fuselage at the wing, which has miraculously been fixed by the "Coke bottle" fuselage rule because of the Tiger and the F-102A.

In both designs, fuselage cross-sections have been added locally in the region of the wing by the amount of the wing cross-section.

But it's not always necessary to take new area—and therefore cubic volume—from the space-between designers. Sometimes, it's necessary to add area. One example is: The tail blower on the

Convair F-102A, added by amounts at Wright Air Development Center as part of the major fix required for their airplane to fit in the area diagram to make it match the ideal shape more closely. The estimated nose of the F-102A and the F101 also improve the drag by increasing the tail area and as a side benefit, they produce more useful volume.

Application of the area rule to give of valuable volume ahead and aft of the component, a spare used to give all coverage by the designer.

That's all there is to applying the area rule to an airplane for the case of area-lift drag at transonic speed. But behind this simple plotting technique, a long line of ideas, calculation and test finally led to the development of the transonic tunnel.

The area rule, like many other area control advances originated in one of NACA's fundamental research programs. No god was set up instead the research was strictly done to know what transonic flow looked like, and how transonic drag was produced.

What was the shock pattern on simple wing shapes and body forms? What did the drag rise come? How could airplane drag be con-

trolled could component drag simply be added together?

The answer had to wait for the availability of the transonic tunnel.

This unique tool was developed by John Bieler, Assistant Director of Langley, and was for him the Collier Trophy for 1951. Whitcomb directed the study which included some pressure distributions and Schlieren photographs.

The technique was that, first, they showed the existence of a strong normal shock behind the trailing edge of the wing-fuselage intersection, in addition to the normal shock over the nose. This shock extended way out into the stream so that its pressure was large compared to the size of the wing-body combination. This was Whitcomb's first idea. The transonic drag rise was caused by losses from that shock.

Other data followed from the study of the results of the first test. The shock formation and the drag rise at low lift for the wing body was similar to the expected drag of bodies around a modified body of revolution. That body had a swelling around its middle like the egg tank of an outboard, the swelling represented the additional cross-sectional area of a wing, wrapped uniformly around the body. Then, the

area change from nose to tail of a wing-body combination was depicted from the area to tail by the compressible body of revolution.

While these results were being studied, a different series of tests were being made in the transonic tunnel. It was planned to evaluate the magnitude of the transonic interference drag, and the tests were made with wings, an swept and delta wing plan bodies with differing camber at the wing.

The set of tests showed three major facts about interference drag:

- Wing-fuselage interference effects are greatest at transonic speed and may be as large as the wing drag alone.

- Fuselage shape changes—area and cross-sectional large variations in wing and interference drag.

- Wingbody combinations must be treated as an aerodynamic system with the wing-fuselage drag actually dependent. Total drag can't be computed by simple addition of the drag of wing, fuselage, tail and other areas.

With these conclusions, and those of his own studies at a low, Whitcomb reasoned that the interference drag was the source of the largest portion of the transonic drag rise. Reduce the interference drag, and the transonic rise is lower, not eliminated. Then he went back to the flow studies for a second look at transonic flow.

Flow Review

This is the point at which Whitcomb had to "test" his or in order to better understand an idea further. Others before him had tried a simple attack on the drag problem, but had no more than a guess for what was needed that there was no practical way in pursuing the idea any further. Perhaps this effort never gained completely the transonic flow picture because their approaches were mathematical. They tried to analyze the flow without any consulting what happened.

The aerodynamicists worked with differential volumes of air, with stream lines and with stream tubes. The differential volume is, in the present context, an infinitesimal small unit of air. It moves along a flow line called a streamline if it follows that line, the streamline is straight. If the air flow moves around a wing or body, the streamline curves displaced by the existence of the surface in its path.

A bundle of these streamlines is called a stream tube. A common approach to the theoretical analysis of air flow problems is to use a stream tube which contains the object under study. That's what Whitcomb did. He considered two stream tubes. One contained the wing-body combination he had been studying. The other held a compressible body of revolution, a cylinder. He chose to analyze at a circular

section, with the circumference the wing-body combination. The weight of the wing-body contains two. Then he mentally looked at the flow line station to station along the length of the bodies. First, the stream lines diverged around the nose, then along the cylindrical body, and then along the wing-body junction. Then the streamlines closed down again over the rear of the body and eventually came back to the normal path down stream. All the velocity lines, the straight line paths of streamlines, pass through flow deviations in any plane normal to the centerline of the body. But two factors work to smooth out these deviations.

- Pressure changes along the circumference of any stream tube at any plane normal to the centerline. These changes, caused by the relative speeds of adjacent streamlines relative to the surface, tend to smooth out the bumps quickly by changing the flow, around the circumference.

- Rigidity of the outer streamlines along the walls of a wind tunnel, these outer streamlines start displaced inward and move inward until they reach the wall, thus smoothing out all deviations in the flow.

Both the circumferential and the radial flow changes are quickly lost as the flow gets away from the turbulent corner of the body. Whitcomb found that the two kinds of flow-over the wing body and over the equivalent body—were almost identical in only a short distance from the body.

Then he went to the area rule in March, 1952, shortly after determining the rule. Whitcomb presented his whole program to the Langley Laboratory's research department. He had no proof of his idea but he had a picture of it with his computer with few exceptions. They suggested no permanent restriction.

Tests of simple wing-body combinations and that appeared to be the first in April. By the time Whitcomb had completed a certificate to his original theorem of area equivalence. The results, and in effect that a wing-body combination could be made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag. Along the way, the body was made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag. The body was made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag. The body was made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag.

The tests were the first proof of Whitcomb's reasoning was justified in the transonic tunnel. Before the photographs and drag curve that came out of the transonic tunnel. From now on, the wing could get a free ride.

The magnitude of the drag using was minimum. For an aircraft, the drag was the least drag, the drag of the wing was reduced by

60 percent. For a swept wing, the drag was also decreased completely at Mach numbers up to 1.84. Above that mark, the effect of the modifications wore off for zero-lift conditions.

Two Airplanes

By August 1957, things looked black for the Convair F-102. Intruded in a supersonic airplane, it was stuck at Mach 9. That was reason that USAF would cancel the contract. Transonic drag at NACA's 8-ft. tunnel showed the drag bump at transonic speed was about the capability of the airplane. Convair and Langley expected that at Langley was decided that the solution lay in the area rule. The Convair engineers returned to San Diego, taking their model for review.

In October, a duplicate form Convair came down, showing it knew what about the area rule. They were coming up with a new fighter, an which a lot of Convair's time was waiting. By February 1955, they had made models for Design 60, Convair's designation for the F-102, to be tested in the F-101. Whitcomb visited Convair and helped work out the Tiger's final form.

Knight came that, a modified model of Convair's F-102 went to the transonic tunnel for evaluation, and again Whitcomb made the task to a new structure to decrease fuel loss with the supersonic. In July 1955, the layout of the F-102A was completed.

In the meantime, the transonic tunnel had been built, the Convair Design 60 model. The results were good, the Tiger was going to have relatively low transonic drag. By August the tests were completed.

The area rule, the F-102A tests had ended. The final results and what Convair engineers wanted to know. This airplane would be successful. All that was necessary now was the flight tests.

As it happened, Convair got the first in April. By the time Whitcomb had completed a certificate to his original theorem of area equivalence. The results, and in effect that a wing-body combination could be made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag. Along the way, the body was made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag. The body was made to look like a body of revolution by a minimum drag ideal body, and would therefore have minimum drag.

A few months later Convair's Richard E. Johnson flew the F-102A, up to 84,000 feet and went past Mach 1. While still climbing.

Crack design have since followed. The area rule is being used in the area rule for better performance. New bomber designs are also using the area rule. Whitcomb's brilliant concept and thoughtful experiments are paying off in the next generation of fighting planes.

Air Show Move to Philadelphia Results in Record Attendance

Philadelphia—Record-breaking attendance of 254,550 and a perfect safety record at the 1915 National Acrobatic Show last week justified Delaware Dignitaries' contention that the spectacle be moved to a new city with emphasis on the progress of America's air strength.

While street shows in Dayton and Cleveland, Ohio, this year's parade and flag exhibits resulted in no critical undertones from either military or anti-military organizations.

An impediment factor in this was the opportunity given U. S. Navy, an open volunteer participant, to play host to 25,000 visitors aboard the cruise. Accordingly, the event adjacent to Philadelphia International Airport, Navy's living show included catwalk launching of the McDonald's F21 Rainbow and Chance Vought F7U Coffee jet fighter. Situated against the six shore the Delaware River, clearly was more visible from the stand-

U. S. Air Force's weather institution of a 2,500 ft ceiling and five under visibility forced cancellation of the USAF flying demonstration on the opening day of the show. Flies of the McDonnell F-101 Voodoo and Lockheed C-119 Hercules turboprop transport as well as a long list of fighters, bombers and transports shown in previous years clearly impressed the Philadelphia crowd on the other two days.

'Report to the Treasurer'

Patent file as a show horse was staged on Labor Day by Carl Houser, a Haver, winner of the Thompson Trophy, who steered past the stand at scoring speed. To win the prize he

Ryan Navigation Unit

Evco Accounting Co. will produce a new automatic self-contained volume registration system, the ANQAPN 57, under a \$5 million contract recently awarded by Natick Army.

Operating without ground-based facilities, such as are required for VOR or TACAN, the Kyuo-developed AFN-67 provides continuous information on position, ground speed, ground windings, drift angle and ground track. By setting in data on the point of departure and the final destination, the device can provide the pilot with a single indication of his deviation from the prescribed course.

The AFN-47 presumably could find use in civil aircraft and helicopters once security restrictions are removed. The device consists of a dual-redundant computer which employs a continuous-wave (doppler) radar to measure aircraft movement over the cockpit. (AW Dec. 27, 1994, p. 43). The anti-collision has undergone three years of flight testing in the Navy and the Navy.

The Navy reportedly plans to use the new Ryan submersibles to explore And-
erctic waters (Expedition Deepseas) and to find magnetic anomaly variations over
the ocean and sub-sea regions (Project Magnet).

had set a record of 312.335 mph over a measured course in Palmdale, Calif., beating the North American F-100C.

All USAF press releases, of course, carried past teps, carrying out the Air Force effort to make the show a "Report to the Trooperc." In addition, the USAF script for the show drew contained complete information on the

This show is designed, he said, 'as an annual report to the American people on the status of American society - whatever your political beliefs. I am confident that the Christians who view this show will see the need to promote the cause of world peace if we are to have true coexistence.'

1956 Location Not Set

Inductive comments on the 1955 show was uniformly favorable. Shift to Philadelpia and a new East Coast audience brought out larger and more elaborate exhibits. Promoters parking was good, with bus service to the airport, spending movement of the crowd and lively conversation of a musician.

Fred C. Crawford, board chairman of Thiopac Products and show president, said no decision will be reached on the location of the 1998 exhibit/pooling conference until the Defense Department. The show management and exhibitors have been scouted from Minneapolis, Chicago, Ft. Worth and two West Coast cities.

At the Pentagon it was reported that

Air Trophy Winners

Winners of major events at the 1991 World Aircraft Show include:

Thompson Trophy, to Col Henry A. ...

Baseline Transfer to Col. Carlos M. Albino, USAF, of the Tactical Air Command's 40th Fighter Day Wing, Foster

Yes, there was one fly other than a speed run from George AFR, 1st, to Philadelphia, a distance of 118 miles. Talbot's average air speed for his 1800 was 550 7/10 mph.

General Electric Trophy, in the Steno Air Commemorative 1200th hour fly each AFR. Cold Air was headed by Lt. Leonard J. Stevens flying a Boeing B-29 Superfortress bomber from Philadelphia on March AFR, 2,337 miles, at an average speed of 197.29 mph. They defeated 8 of seven times.

withstands AFB₁ stress, and the 194th

Alben Topley, to a ground crew here at Flying Training Air Force, Webb, Tex. Big Spang, Tex., headed by Staff Lt. Richard D. Wright. They changed the Allison J18 jet engine in a Lockheed 10 Shooting Star in 10 minutes, 12.2 seconds, defeated five other teams from around the country and the Ames Research Center.

Defense Department first made whether or not military participation will be sanctioned, peak view was expected that the 1914 debt

has remained over the relative magni-

the Defense Department first must decide whether or not military participation will be sanctioned, and vice versa. It was expected that the 1994 debate will be resolved over the relative merits of the National Aircraft Show compared with more elaborate Armed Forces Day programs and a national presentation of the air power story.

*U.S. Army Aviation units reported most of their 1994 presentation was the exception that this year's show featured the Pave III H-24C Wild Horse Army show was changed to "Little Pave III," a simulated attack base that encompasses 400 feet

• U.S. Marines demonstrated an HRS-1 helicopter equipped with rocket-assisted takeoff (RATO) engines to increase takeoff and lift performance.

Army's 80th Helicopter Company, Ft. Belvoir, Va., received a citation from Army Under Secretary Charles C. Frazzane, awarded for the unit's work flying 168 hours on rescue missions during the recent floods in the North-east states.



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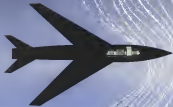
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AERONAUTICAL ENGINEERING

How Russians 'Stormed Sonic Barrier'

To their long list of aeronautical accomplishments—both real and unproved—the Russians have added the practical application of sweptback as a means of reducing speed drag at high speeds.

The climax came to light through an article in the Red periodical *Otkrytiya*.

The article presents the Soviets' modified history of the development of sweptback aircraft. It does mention the German Me-163, first operational sweeping plane, but not its wing form. It says that similar Western planes all crashed, thereby proving the general lack of knowledge in the West.

It completely denies or overlooks the pioneering work done by the Germans, North American's sweeping Sabre which flew in October 1947, and Boeing's B-47 which was being designed with sweptback wings at the end of World War II.

Even with these important omissions, the story makes interesting reading. It sets in place the relative state of the art in Russia and establishes Lavochkin as the pioneer of the development of sweptback in Russia.

Mikoyan and Yakovlev also are credited with designing aircraft which "... with sweptback wings... are now the pride of our aviation." Mikoyan's design is the MiG-15 and its later variants, Yakovlev's specific design is not known, but the story lends credibility to first-hand German reports of a Yak-25 sweptwing fighter. A translation of the article's highlights follows:

The deed of creative thought and the battle of technical ideas goes on in the quiet of designers' workrooms for many years. In one and the same there is no leap either for a day or in the next thought which has no temporary armature, no full victories, no astronomical success.

The designer's quest is an unending and troubled one. He must eternally alternate with the solution of one troublesome problem—speed and altitude.

In the Beginning

Not long before the end of World War II, the situation of our designers was driven to some interesting information which came from beyond our borders. In Germany tests were being carried on with a new jet fighter—the Messerschmitt 163, equipped with a Walter engine.

The mere appearance of a new plane wasn't surprising. But some of the things witnessed during the tests were astonishing. The powerful engine enabled the plane to fly at very high speeds.

However, somewhere beyond the speed of 500 kilometers per hour the fighters exhibited real measurable plane refused to respond to the pilot's will. Close methods of controlling the aircraft suddenly became worthless. The

plane spun into an uncontrollable dive, and the tests ended in catastrophe. The Messerschmitt firm stubbornly continued its experiments. Plans could not allow consider, but no explanation was found for the mysterious phenomenon.

At the very same time similar tests were under way in Great Britain and with exactly the same results. In testing British fighters the British tried to reach top speed in a power dive. But the plane went out of control. It was necessary to use instruments of effort to change the position of the tail, steady two-lane control sticks.

The plane acted with increasing strangeness. Dangerous phenomena such as vibration, a wing, a wing and the whole airplane structure were changed. And again catastrophe.

Catastrophic also catastrophe. The most experienced pilots perished over airplanes far behind the front lines. They had nothing to show for their deaths, not having reached aeronautical science onto the way ahead.

After the end of World War II the United States also became seriously engaged in the solution of these problems.

The Americans evidently had made too much haste. Underestimating the

nature of the phenomena which occurred at great speeds and not having studied the extremely complex processes that take place in the new field, they thought they would succeed in dividing all the questions directly through test flights. They were wrong.

Plans after plans were built with a knowledge of the unknown. The Americans changed profiles, changed and steadily some groupings of the components. But the planes and the planes were lost.

Newspapers and magazine columns were filled with breathtaking accounts of the tests. Sensation followed sensation.

At last that time there appeared in the American press for the first time two words which made hearts skip a beat even in plain noncombatant designs. The two words were "sonic barrier."

Some people hastened to proclaim a crisis in aviation, other contended that aviation had run into a blind alley.

Soviet Deliberation

Soviet designers didn't rush to build experimental planes, they didn't hurry to get up into the skies until they had undertaken profound research into the laws of the new phenomenon. The fight for higher speeds was brought into special scientific research centers.

Taking the lead in this work was the largest institute—TSAGI (Central Aero-Hydrodynamic Institute) headed by the father of Russian aviation N. Ye. Zhukovsky. Even before the end of World War II broad research was carried out here into the phenomena associated with the speed of sound and the laws for solutions to the main problems were laid down.

(Here the author discusses the nature of the phenomena encountered at the "sonic barrier.")

The TSAGI laboratories, under the direction of the young physicist professor Vladimir Vladimirovich Stankovskiy, carried on intensive research into the physical picture of air flow around bodies moving at high speeds. The scientists needed for essentially new methods of measuring the difficulties which arise at these speeds.

First Breakthrough

The investigations went on in a single direction toward the possibility of increasing drag at the wave crest ("sonic boom") so that states of flight could be slowed. At first there were few people who believed in the practical value of these investigations. But designers

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was easier to overcome than the wave crisis. The scientists stubbornly carried on.

If the old laws of aerodynamics turned out to be useless for solving any problem, then it was necessary, after first comprehending the nature of the phenomena, to evolve new laws and create an entirely new branch of aero-aerodynamics of supersonic speeds. This was the job of a large group of scientists, engineers, and designers—a historic task which marked the beginning of a new era, a new epoch in aviation. The theoretical basis of the amazing phenomena was laid (in the TRAGI laboratories). Now all in time research rested on a firm scientific foundation.

In 1940 the group headed by V. V. Shchegolev had its first victory. It was a day of celebration, but for and love of people the victory of the scientists passed unnoticed. The newspapers carried nothing about it. Such is the fate of those who work in the advanced area of technology.

Lavochkin's Role

Scientist-designer and Hero of Socialist Labor Sergey Alekseyevich Lavochkin worked in this advanced area in the struggle for higher speeds; his design bureau also solved in search of means of sharply reducing drag.

At first an attempt was made to find a solution by decreasing drag in small amounts by improving the distribution and arrangement of the fuselage and by working on the finish of the surfaces. Then they tackled the wings. They began to make those thinner and sleeker and sleeker.

So much was hypersonic, so much was alien and so much was unexpected.

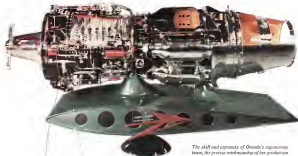
Every new refinement was carefully studied. The planes were tested in wind tunnels and tested in the air. Success was modest, and they progressed slowly, literally fighting for each additional 10 kilometers of speed.

At one stage the designers thought they were close to their goal. Many tried dozens of different variations of fuselages, wings, tails and groupings of components and having gathered to gather all the accumulated experience they decided the jet fuselage is the airplane of the best elements of previous models.

Outwardly the machine differed hardly at all from its brother—the same straight wings, only thinner; the same fuselage, only more streamlined. In short it wasn't a long selection of the problems, and the designers didn't form any illusions. They didn't even count on the new plane being able to fly at sonic speed, but it could get close to that speed. The entire factory "lived"



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the analysis, for several months. All the engine energy of the huge rocket force was put into this one analysis.

Work went forward in the shops, but to the degree that the plane around completely a feeling of dissatisfaction grew and strengthened inside Lavochkin. He realized that it was necessary to find some sort of essentially new approach which would result not in small decisions to dig at minor points but in immediate, sharp indications. This thought didn't leave him at his workbench, in his car on the way home, or late at night.

Enter Sweepback

The TSAGI group headed by V. V. Strannsky was slowly busy at this time with research on the building of an essentially new type of wing—swept (wing back). According to the necessary hypotheses, such wings should come out for all elements those difficulties of development during that up to this time seemed insurmountable. But here the scientists ran into serious trouble.

On the one hand, sweepback helped ease the wave crisis. On the other hand, where there was a large angle of incidence (attack), during attack and landing, and particularly while maneuvering, there were sharp, unexpected phenomena associated with the sweepback. There was a breaking away of the stream of air particles which flew around the wings. The plane lost stability and controllability. It fell off on the wing

and went into a spin. If this happened at low altitude the pilot couldn't even save himself with a parachute.

TSAGI scientists found a means of removing against such difficulties. Strannsky was especially sure that nothing unexpected would come to the fore. But how could he convince the designers of the necessity of his hypothesis and persuade them to build a plane with sweptback wings when lately every test of such craft in the West ended in catastrophe?

Lavochkin was the first to make a firm and unconditional decision to build the new plane design at his factory. Together with his assistants he would succeed to study a multitude of models of his future aircraft, perfecting their form and finding the best aerodynamic groupings. And although construction of a new plane with swept wings was already nearing completion in the same shops, he had the time to gather his staff together and tell them his story.

"We won't continue in that direction. We must start all over again."

Much courage was necessary to step out at one stroke the results of previous work and begin from scratch.

Nobody in Russia had yet built an airplane with sweepback wings. Nobody except Lavochkin could expect confidence that such a machine would prove itself in the air. Then, too, some times even the most adaptable hypodermis had turned out to be worthless when put into practice. But Lavochkin



Body Movement Guides KH-15

The pilot Norman M. Kaye demonstrates stability of multijointed helirotor KH-15 by flying the craft with body movements only (muscle-throttle control). The KH-15 was developed under Office of Naval Research sponsorship to study stability and handling characteristics of a small engineless helicopter to which significant rotor power could be supplied instantaneously so that the KH-15's gas induction system can be applied to any type of helicopter. Powerplants are two Reaction Motors hydrogen peroxide motor engines, one on each side of tip. Fuel is carried in the two spherical tanks (displayed the pilot).

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and design are always the result of our creative genius, and Greenleaf will add facilities there for other clients of his design bureau into construction of the new plane.

Before him lay a thick stack of drawings of completely original profiles for a plane. There was a narrow, cone-shaped body, a sharp tapered nose and an elegant tail section slanted to the rear. But the most striking was the wing—short and angled backward like an arrow. The plane looked like an aircraft ready to pounce from a tower.

That came into being the first Soviet plane with arrow-like wings which enabled the bypassing of today's swept back aviation. It was a daring, novel, honey back with crisscrossed canards. But the discovery didn't just fall from the ceiling. It can't be explained as a happy thought which suddenly and accidentally came to mind or as the result of the gifted perspicacity of its author alone. It was prepared and pieced together by all the previous progress of our advanced Soviet aeronautical science.

Yes, our people radically changed the concept of drag in flight at once speed. If formerly drag was designated by the figures 7, 99 and 14, now it was only two or three times at the same time. That was an entirely valuable drag which could be overcome by engine power.

Only the Beginning

But solution of the main problem around a series of new and unexpected ones in front of the designers. Some other way of mechanizing the wing, some other system of controls, different fueling and different fuel assemblies were required.

The plane had to fly not only at its previous speeds but at the low speeds necessary for landing. However, the level of airflow at subsonic and supersonic speeds were different. This meant that the aerodynamic composition of the plane had to be such that despite the different laws of airflow the craft would have the requisite stability and maneuverability under any flight conditions.

There had to be an exact value with which pressure for the pilot's safety. . . . It was necessary to rebuild the entire system of controls, adding special apparatus to combat the strong supersonic breeze encountered at supersonic speeds and to keep under the pilot's "feet" of the plane. . . .

At last, gliding under the sun's rays, the first experimental plane with arrowback wings was slowly rolled out onto the airport's concrete runway.

Stunningly smooth stoppage. Lurching. The pilot fastened the canopy back and took off. He considered

INSIDE STORY AUSTENAL SILENT TREATMENT

This is the inside of a creep rupture machine at Austenal Laboratories. A bar of ultra strong alloy is subjected to high stress for many hours at jet engine temperatures until it finally ruptures.

The drawing symbolizes determination of rupture strength of an alloy to be used in Austenal's Microcast process for the structural casting of high temperature components for jet engines. This is one of many laboratory tests used to ensure the quality and dependability of the alloys used.

The alloy was made in Austenal's own alloy plant. Skilled metallurgists and chemists produce alloys to pre-determined specifications and check and re-check each individual unit to ensure high quality standards.

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ALLMETAL'S HEX HEAD STOCK—special includes 2.56 x 3/16 cap screw (L1700 in.), and 1 1/2 x 7/8 bolt (a weighty 3 lbs., 7 oz.). Between these two extremes, 407 different hex head bolt sizes are carried in stock.

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Leading manufacturers launched a switch to a fast growing firm (specialists in stainless steel) for their fastener supplies. They found that there's no stock like the largest, and Allmetal Screw Products Company has the largest stock of stainless fasteners in the world.

One significant reason manufacturers find Allmetal stainless fasteners so fascinating is their hex head bolt stock (see cut). And talent to follow through with fast delivery of screws, nuts, washers, rivets, pins, nails, and "AN" fasteners.

Chief cause for Allmetal's ability to turn out fasteners—and have them ready for immediate shipment—is their sparkling new plant in suburban New York (Garden City, Long Island). These added facilities—plus 26 years of specialization in tough alloys—give Allmetal the combination to supply stainless fasteners when needed. Stock list brochure available.

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GARDEN CITY NEW YORK

powered blade. No, the plane didn't break apart. It handled efficiently and landed without incident.

Success of the experimental machine at once dispelled all doubts which will contend with speed to airport back stage. At the factories (designed by designer A. J. Moloney and A. S. Yakovlev) new military planes with sweptback wings were built which are now the pride of air armies.

Lavochkin also built a new plane. And at the designer formerly was held back by fear of the unknown, now this seemed bold. To achieve greater speed the sweptback was increased in length by 100 feet.

But even such small changes in aircraft design required extreme research, test and caution. And the fact that flights didn't always end well for the plane.

In Moscow cold weather arrived. It began to snow. Lavochkin shifted his new tests to the south-on the shore of the Black Sea. It was thus decided to try to speed matters speed out of the engine-to try, as they say in the West, to crash through the "snow barrier."

A new instrument—the Mchmeto—was installed on the instrument panel.

Supersonic Parade

Thus everything was ready for the dawn flight. Test pilot Col. L. Ye. Fedorov took the plane out on the runway without hesitation, took off, made a forward circle of the airport and disappeared into the blue sky.

The engine was working at full power. The instruments showed an altitude of 50,000 meters. The earth was a light gray blotch beneath the disk of cloud cover. Lavochkin's record could be held in the pilot's compass.

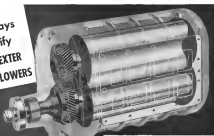
Fedorov carefully looked the engine and then smoothly went it into a dive. The plane shot downward. The Moloney could slowly snap upward, limited slightly at the mark and, having passed it, tucked round into the second circle. The job was done. Fedorov pulled back on the stick and brought the plane out of the dive without difficulty.

He was at 4,000 meters. Pulling off his engine must be prepared to land. The historic event of engineering the "snow barrier" came off with delicious ease.

The glad tidings were flashed to Moscow. And from Moscow to the shore of the Black Sea came other news. A plane built by designer Moloney had overcome the "snow barrier" almost simultaneously with Lavochkin's. Within a few more days friends congratulated designer A. S. Yakovlev (on the next achievement).

[The dates of these flights are not

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gases. In the U.S., Maj. (then Capt.) Charles Yeager went through the "inter-burner" in the Bell X-1 research plane, Oct. 14, 1947.—ED

With the "space burner" done away with, we began to build safety and never again, each more advanced than the others. As we did, the top speed increased by nearly 100 and 100 kilometers per hour.

Performance of the new machines was studied at the airport experimental facilities, and the latest improvements were introduced. Suitable models were prepared for quantity production. Even here, however, with the basic problems already solved, everything didn't go smoothly. Difficulties did continue to confront the designers.

Mesh Speeds

One of these involved Lavochkin. Under certain comparatively rare circumstances during tests the structure of his plane began to vibrate. Test pilot Fedorov easily stopped the vibration by changing the conditions of flight. His assistant Lavochkin, there was nothing to be concerned about. Lavochkin wasn't concerned but, as it so might, he couldn't find the cause even after 10 flights.

Finally he attached a device to the control stick which recorded the pilot's actions. . . . Fedorov took off and soon experienced vibration difficulties. . . . Then he heard a sharp crack, and the plane began to break up. . . . The pilot bailed out. . . . But the recording instrument and its record were found intact inside the crashed plane and it detected the cause of the vibration. Lavochkin diagnosed the trouble by adding a kilogram of weight to the tip of the tail assembly. . . .

Now, with speed increased a notch, Soviet designers have run up against "temperature troubles"—the last barrier.

At speeds above 2,500 kilometers per hour the fuselage and wings heat up to 210 degrees Centigrade. That's only one of many problems.

The article continues.

Lockheed Gives Report On Half-Year Earnings

Beltsville, Md.—The half-year earnings of Lockheed Aircraft Corp. were placed at more than \$9 million, or \$1.21 a share. President Robert E. Gross reported last week.

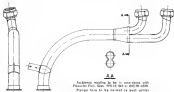
The figure represents a slight drop from the first six months of 1954 when earnings were placed at \$10 million or \$1.15 a share.

Higher salaries from expanding core aircraft production were offset by a re-

FLEXON DUCTING

Design Briefs

Complex Anti-Icing Duct Problem Solved with Unique Assembly Engineered by Flexonics



Anti-icing ducting for use in one-piece with Flexonics Inc. Size: 100 x 100 x 100 x 100. Proper design is the secret to such systems. See article on p. 12 and 13.

Check FLEXONICS for any of these components:

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FLEXON METAL HOSE, precision constructed steel, is constructed in the lowest cost variety of sizes and types for all aircraft engine systems.

FLEXON BELLOWES, are made in an almost unlimited range of sizes and types to meet the most advanced requirements.

Intrinsic forming problems combined with the high dimensional accuracy requirements in production created a tough development problem in the anti-icing duct assembly sketched above. The transition-tube design is cross-sectioned. An A was used as high formed from a single piece of welded 302 tubing (not two half shells welded together). The assembly is most tested at 300 psi for five minutes. No evidence of leakage, cracking or deformation is permitted. Duct operates at 150° F.

Here's another example of the kind of weight-saving and sound engineering design resulting from years of patented engineering and the most advanced manufacturing techniques. You can put this skill to work for you by sending us a outline of your ducting requirements. Flexonics engineers welcome the opportunity to work with you towards the realization of your ducting problems.

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EIGHT-PLACE L2-5 HELICOPTER is playing a leading role in Doman's plans for expanded production and sale of commercial craft.

Doman to Expand Civil, Military Projects

By Ervin J. Bollen

Douglas, Canada—Doman Helicopters, Inc., is preparing a major expansion to meet its planned military and civil rotary-wing aircraft program.

Final decisions on the requirements, including the additional financing needed, will be made within a month, Doman company President Donald S. B. Waters informed *American Wings*.

The company's new activities include:

- Work on Phase I of a full-scale helicopter (PH1) contract for USAF.
- Design of a large four-engine craft which has been submitted to Royal Canadian Navy's new anti-submarine

craft competition by the company's licensee, Doman Fleet Helicopters, Ltd., Fort Erie, Ont., which has the primary responsibility for the project. Fleet is supplying manufacturing facilities, Doman-Dawson the engineering backup. Doman Fleet feels that its production capability gives it a decided advantage over other entries who do not possess Canadian manufacturing plants.

- Study of helicopter all-weather instrumentation.
- Preparation for production of its \$125,000 L2-5 eight-place commercial helicopter. The L2-5 is expected to arrive in Type Certificate from Civil Aeronautics Administration within the next two months, according to Doman officials.

CAA plans are now flying out of the two T41 military conversions of the L2-5 under a Type Inspection Authorization to verify design and perform some data for final approval.

An expected initial purchaser of the L2-5 is Heli-Mex, a Mexican firm that plans a network of helicopter services throughout that country. The new Doman would be used for trunk routes and light lifts for feeder operations. Heli-Mex currently is negotiating for seven L2-5 with options, costing approximately \$3 million. Women and initial deliveries can be made six months after a contract is signed. Doman expects to train Heli-Mex crews here in Dowdley and will assist the company in setting up service facilities.

Waters said that during a trip to Mexico with Cles Montgomery, his sales manager, he noted "terrible" enthusiasm for the helicopter. The governor of Vera Cruz pointed out 130 towns in a map of his state where he said he would provide helicopter facilities. The governor, Waters said, also presented his concerns and other benefits for the Heli-Mex operations.

L2-5 output at Dowdley already meets the word "go." Production drawings are completed, tooling requirements have been decided upon and some 150 workers have been hired up already. "All we have to do is write the work orders," a Doman official said. An early indication of L2-5 production plans is given in the report that the firm's engine supplier, Lycoming, has



ALL-WEATHER instruments being studied by Doman for helicopter include Lead Nuts (1) and Speculation shock isolator (2). Nuts secure instrumentation in severe conditions.

cooperated in extending testing runs for the 80-550 over a speed of 180 powerplants.

Additional design growth is foreseen in the L2-5's future. For example, in using a monocoque fuselage, assembly could be speeded and the added stress during wind tunnel tests, the engine's speed by about 35 mph. Major design developments may include use of fibrous glass reinforced plastics and carbon fiber as expected to be included to reduce all-weather weight. Plans also include use of shock absorbers on the ground door post landing gear.

Military Work

As part of Waters' policy to pursue sales strongly in defense work, Doman has put around engineers on new military projects. The company submitted a proposal to the Air Force on the use of helicopters in fuel trucks and then won a Phase I contract over 11 competitors to work on the study. The contract phase, dated for completion in December, involves adaptation of three current aircraft—the Pave III H-21, and

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The intense vibration of a jet engine can break the contact of ordinary thermocouple connectors. Furthermore, the extreme temperatures frequently in excess of 300°F can cause inaccuracies in the readings. However, T-E's new jet-couples can help take these problems.

Jet-couples are T-E thermocouples combined with unusually rugged and accurate connectors. The connectors can be tested quickly and easily, yet they withstand severe vibration and high temperatures (1000°F or more). To prevent errors from temperature gradients, elements are made of thermocouple materials—oxid, when limited on hazardous and thermocouples, are performance present sub-setting.

Take your choice of exposed loop or in-situ jet-couples. If you wish, T-E will design and produce jet-couples to meet your specific engine requirements.

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THREE-ENGINE ASW COPTER is shown in this artist's drawing of the design study.

slowly at H-14 and H-17-to-fuel tanker helicopters.

The F7H concept is planned to provide greater on-the-field mobility in Army ground forces by absorbing heavy vehicles from the air by capture, leaving the forces free to disengage upon slow and valuable tank trucks which are committed to many roads. The tanker concept could also reflect other copies and Army aircraft in mid-air.

In its bid to win the Canadian contract, Dornier Fleet has proposed an autonomous helicopter which would gross approximately 17,000 lb. and is planned around three General Electric T53 turbos. The powerplants are rated at

the upper ranges of the lineage, but behind the cockpit, Weapons are carried in retractable launchers in the large cabin. The ASW copies are not in budget as that it folds speed over the lineage. The four main rotor blades also fold to facilitate storage of the copies stored in transit.

The new ASW project is a joint effort between the Dornier firm and Dornier Fleet Helicopters, Ltd., Orléans, D.F. is at present primarily a manufacturing facility but eventually plans to become a completely-integrated design, development and production organization. The Canadian firm will be responsible for design, development and

production of the ASW copies if a government contract is received.

Projections of the design for end use have also been laid out. The commercial version, powered by three T53s, would seat 20 persons and have multiple loading, including a ramp under the tail. Another series configuration was planned for tandem roles.

John Moore, director of military contracts, and the company is not committed to any particular design philosophy. Single or tandem roles as both under consideration.

Capit instruments

To improve cockpit utility and design as all-weather capability, Dornier is also doing considerable study of instrument requirements for rotary-wing operations (AVW Sept. 5, p. 45).

Ward Dorn, formerly of Lear, who works in customer relations, is evaluating current equipment in an effort to develop a standard blindflight panel of the last available instruments. The requirement is that be an 48-in.-dial dual, as production or programming production time. Among the instruments Dorn currently is studying is the new Lear three-needle Null potential pressure indicator, which shows direction and flow angle and direction, and angle of bank and heading on an aircraft scale (AVW June 15, p. 43). Another is an instantaneous vertical speed indicator, which is used to show immediate changes in rate of change of altitude of a hole in 100 ft/s. This instrument is manufactured by Spectronics, Inc., Syosset, N. Y.

The instruments Dorn will study is developing of a standard panel include attitude and heading indicators, air speed, instantaneous vertical speed, yawmeter, magnetic compass, miniature altimeter and engine instruments. A turn indicator, indicator will be used in a similar in view of future of the attitude indicator.

Dorn would like to see an integrated indicator with an expanded scale in the 30-60 mph range with relatively slow needle motion during helicopter cruising speeds. Many current instruments, which were developed for forward aircraft, have too much needle "bounce" in their low speeds to provide the accuracy for rotorcraft work, Dorn said.

New Aerodex Contract

Aerodex, Inc., has received two USAF contracts totaling approximately \$4 and has its current engine models at its Miami plant. One is a follow-on order for Wright R2600 turboshafts through July 1965. The other, for Pratt & Whitney K1800s, will run during the same period.

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to conform to applicable specifications for power packs and controls. Before choosing your flush latches and hinges, just ask yourself one question...who was first? HARTWELL equipment is used by every major aircraft manufacturer because it is designed for application.

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The demand exceeds the supply. It's that simple.

There are three engineering jobs available for every two engineers. As a result, if you are a graduate engineer, scientist or technologist, some \$3,000 opportunities are bidding for you with offers, inducements and lures and more. But don't be mistaken! Most of today's opportunities are jobs, not futures.

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and careful evaluation, you of us and we of you, with the possibility of your joining one of the finest team operations in the whole new world of flight systems development.

Most of the people on that team are young and moving ahead fast, in an industry whose future is unlimited. They weren't hired here. They found out — and figured out — for themselves. We hope you will do that, too.

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Selected wires and insulating fibers, individually fabricated into conventional elements or odd-shaped units like circles, half circles, ovals or tapes, ranging extensively in size, filling specific needs.

Silicone rubber is one of the most versatile types of insulation for heat elements developed in the past three years. It withstands into a resilient jacket that is heat-resistant, moisture-proof, and oil-resistant. For long periods it has excellent stability and flexibility through a temperature range of -50°F to 500°F without destruction.

The applications for silicone-insulated heat elements in industry as well as aircraft are almost without number. Some uses include gyroscopes, servomechanisms, temperature sensing elements, aerial cameras, aircraft heaters, and heaters for windtunnels, bearings, oil accumulators, motors, and UHF antennae.

Wires heat elements powered by silicone, are ideal materials to meet the most exacting requirements. Elements made may be more effectively insulated with silicone rubber or reinforced plastic insulation. For your copy of a brand new, illustrated folder, write to:

Safeway Heat Elements, Inc.

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THRUST & DRAG

Today's lessons in Technical English come from a recent report issued by a large Government aeronautical research establishment. The report is aimed at the "flying burner" or the spray-dust operators.

The major problem was to find ways to improve the thrust efficiency and, particularly, to make it wider and more uniform. Following are the conclusions of the report, with translations into Colquhounese.

1. Greater lateral dispersion of aerial spray will result when the position at which droplets are ejected is moved toward the wing tip, where the mean diameter of the droplet spectrum is reduced, or when either the angle of lat coefficient or the altitude is increased. Translations: Move the nozzle outboard, make them smaller, fly higher and a little slower.

2. The uniformity and effective width of the swath is improved by increasing the mass ratio rate with distance from the plane of symmetry. Translations: Put more nozzle near the wings than you do near the fuselage.

3. As compared with a spray spectrum of 180-micron mean diameter, the spray spectrum with a mean diameter of 300 microns allows greater flight path space and produces a more uniform deposit. Moreover, the degree of uniformity is less sensitive to changes in the spacing of adjacent points of the orifices.

Translations: The smaller the drops, the better.

4. Various *Aircraft* new language letter (AW 125, 1955, p. 104) is a good idea, but it is incomplete, and even a little more work is needed to make it completely practical. So I've proposed a modification, which is offered to the editors, ends.

It consists of a simple physical section of the spray beneath a DCG or DCT test. Otherwise it is a mishap of the latest wave of "sawyer" tag, give the consumer can take aboard.

To use it, a consumer about the position of the burner in the vocabulary of the case, and then tries to fit his feet in shoe. If this works, the consumer ahead of him is allowed to place his feet under the seat. Otherwise, the consumer ahead will have to hold his feet in his own feet.

This is much more equitable and I consider the idea will make most from among the hangar-dwellers air travel.

The following came from two anonymous-but-regular-contributors. It's new to me, and so we're not going to pass it.



All business is specialized

... and nothing specializes on your business like your business paper

Here's a smart business man. He spends his first where every stomach punks a prospect at his feet. It's simple sense. He specializes . . . and it pays!

Your business is specialized, too . . . and so is your business paper. The time you spend with it pays . . . for its editors are experts in your specialty. They scout the field . . . report what's good that's new . . . find ideas that worked . . . suggest methods to keep you a long ahead of competition.

The ad pages are as specialized as the editing. They, too, tend strictly to business . . . your business. They bring you data on new products, new standards . . . gather in one place a raft of ideas on when-to-buy-what, or how to make (or save) a dollar.

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One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

Festival

43

1



WIDE VARIETY OF STAMPINGS produced by Tensplet process is shown in this display. Metals are aluminum, steel, brass, titanium.

Steel Rule Technique Cuts Costs of Metal-Blanking Dies

By Henry Leifer

A cost-cutting, time-saving technique for making sheet metal stamping dies and producing stampings is now available for license to the aviation industry.

The patented technique literally sets plywood-supported high carbon steel rules in conjunction with a steel rule die in place of conventional steel plate dies.

It was developed by Tensplet Manufacturing Corp., and is being marketed by an affiliate, Tensplet Industries, Inc. It has been used to cut thousands up to 4 in. thick, various grades of steel, stainless steels, and brass, to tolerances as close as .001 in.

Recently Tensplet has extended the process to the cutting of titanium sheet, producing clean, precise hole of bars.

Republic Aviation has been experimenting with the use of steel rule dies for blanking titanium (AVI June 27 p. 7), and is reported satisfied with the results.

The Tensplet process produces results usually achievable only with expensive dies, the company claims. Shearing, notching, punching, punching, extruding and stamping can be done in a compound operation with one die. It is possible to cut losses with the Tensplet dies.

The die structure is flexible enough to permit working to close tolerances, even where the level of tolerance and depth is low. The dies are light and can be handled, set quickly installed or

removed from the press line of stampings is limited only by the size of the press bed.

Tensplet Industries claims dies made for blanking aluminum have been run even and over, set up using traces, maintained in good running condition after stamping thousands of blanks.

The company claims dies for aluminum should last indefinitely. Exceptionally long life is also claimed for



TYPICAL TENSLET DIE for .064 aluminum produces various parts such as in blank.



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Thanks to the NEW **LORAL** AUTOMATIC SHORT-RANGE

G R O U N D P O S I T I O N I N D I C A T O R

**ACCURATE!
INSTANTANEOUS!**

Developed Specifically for LIGHT AIRCRAFT
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A new fixed tabulating navigational computer—
AUTOMATICALLY indicating ground position—
derived from airspeed, heading and wind.
TOTAL SYSTEM WEIGHT — 18 LBS.



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Sinclair helps A A bite off 3,000 Miles between meals!



Cruising at 345 miles an hour on powerful turbo-compound engines, American Airlines DC-7s span the continent in such short time that if you wish, you can have lunch in New York and late dinner in Los Angeles.* The demand for passenger-space has necessitated additional non-stop flights between New York and Los Angeles, and between Washington and the coast.

Sinclair Aircraft Oil keeps those mighty engines purring all the way, for American has depended on Sinclair for reliable engine lubrication for 20 years. Today, 45% of the oil used by major scheduled airlines in the U. S. is supplied by Sinclair.

And for millions of miles beyond, and the economies totted up, are proof positive that you, too, can depend on Sinclair.

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*Most passengers prefer American's delicious meals aloft.



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what's CLOSED



what's OPEN



what's WORKING



what's STANDING BY



what's NORMAL



what's ABNORMAL

The Keytone 3-Position Indicators at present is being used on aircraft to report more than 44 operating situations. Simple, easy to read, mechanically sealed, reliable, it will report any variable that can actuate a switch mechanism.

Conforms to spec. MIL-I-6835, leading Genz Poroson Indicator. Good coupon for complete information.

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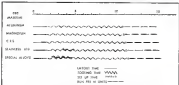


CHART SHOWS TIMES for layout, tooling, set up and running of typical part in various metals, using TYP die and die. Actual part shown is .001 in. diameter steel 17 in. in length.

die cutting other metals.

The TYP die can be adapted to standard presses and will run at full stroke per second.

Production of dies by the TYP die is a truly simple matter, and a die can be turned in a matter of weeks. TYP dies, as part of its licensing agreement, 120 hours of instruction to the licensee. At the end of this time, the licensee will be fully qualified to produce TYP dies, the company says.

TYP die expects this feature of its process to have great impact on the

metalworking industry, allowing the light supply situation with rapid to experienced tool designers and die makers.

How TYP Die is Made

Basically, the TYP die is made by the die maker in a tool cut on a ground block with a sharp edge. A precision cutting tool is used to cut the block, following the pattern layout, to make room for the steel die. The die consists of several steps of hardened steel, somewhat higher than



TYP die produces alternate punch tool 18 in. from die punch stage to stamping.

Responsibility



Rheem

GOVERNMENT PRODUCTS DIVISION

Just as the bold, firm signature of John Hancock signified full acceptance of the responsibilities contained in the Declaration of Independence, so does the Rheem signature, on a prime or sub-contract, signify full responsibility for every commitment to the most exacting demand.

In every operation, from preliminary research through precision engineering to quality-controlled production, responsibility is a sacred trust at Rheem and is the key factor in Rheem's enviable record of low per-unit cost and on-time completion schedules.

The Government Products Division facilities of Rheem are presently in quality development and production on air frames, engine and gas-turbine components, airborne ordnance, electronics and ordnance material.



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FREE AIR TYPE, MS28035-1 to MS-8-8598



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Navy Contracts

Following is a list of unclassified contracts for \$25,000 and over as released by Navy Contracting Offices.

BUREAU OF AERONAUTICS, Washington 25-30

Avco Corp., Farmington 30. 10000000. Design, construction and assembly of 10000000.

Avco Aircraft Corp., Farmington 30. 10000000. Design, construction and assembly of 10000000.

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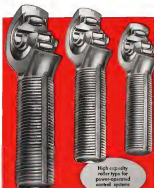
Avco Aircraft Corp., Farmington 30. 10000000. Design, construction and assembly of 10000000.

Avco Aircraft Corp., Farmington 30. 10000000. Design, construction and assembly of 10000000.

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High capacity roller type for power-assisted control systems



Roll bearing rod ends with high-strength shafts for manually operated control systems

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Designed specifically with bearing capacity, shaft strength, and bolt strength all in balance, the new Fafnir series of rod ends is the direct result of an NASC study in which Fafnir engineers participated. Every member of this rod end family is completely new, carefully engineered and tested. Together, they represent the first series of rod ends developed with a significant relationship between bearing capacity, shaft and bolt strength. What's more, Fafnir Balanced Design Rod Ends are made to withstand extreme service under compression with angulation as high as 9°.



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Ladish pioneering in tremendous closed-implosion-die forgings offers engineers new freedom in extending the inherent advantages of the drop forging process to intricately shaped parts weighing as much as 10,000 pounds. Drop forging clean-finish dimensions materially reduce cost and machining costs... while improvement in dynamic strength and toughness makes possible substantial reductions in dead weight... and higher factors of safety.

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Single turbine propeller with the largest known Titanium forging produced in closed-impression dies. 84% saving in weight obtained by forging this 800-lb blade in "one-piece" design.

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1000 pound stainless steel drop forging measures 78 inches in length. Used in a wind tunnel to simulate flight speeds for jet aircraft.

DIESEL CRANKSHAFT

80 inch long diesel engine crankshaft with 7 inch diameter journals and weighing 1300 pounds is another example of Ladish availability in heavy drop forgings. Precise control of grain flow increases resistance to dynamic bending and torsion loads.

EXTENDED LANDING GEAR

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We are interested in your Ladish forging engineer call to discuss application of forgings to your products.

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Company

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"air age" production
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production schedules? Remember,

Continental is equipped and ready to take these worries
off your mind. As producers of a complete line of aircraft
components, Continental has both the skill
and facilities to give you top quality work—as true.

Why not put our skilled technicians,
and production know-how, to work for you.

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Howard Eickelback, Mgr. Sales Engineering, at address below.



**CONTINENTAL
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PLANT 95 Coffeyville, Kansas



Three New Regulators Manufactured by Aro

The Aro Equipment Corp. of Boca, Ohio, has announced the production of three new pressure regulators and a relief valve for aircraft. They are:

• **Absolute pressure regulator.** Model 11274, for electronic equipment contractors, uses engine bleed air or other dry gases. Operating at an inlet pressure of 15 to 250 psi, the instrument has a flow of up to 10 liters per hour and can be calibrated to meet specific aircraft applications.

• **Air pressure regulator.** Model 11280, for regulating compressors bleed air to external fuel tanks, operates without external bleed or external leakage. Suitable for use with air, it is not affected by fuel. MIL-F-5534, MIL-H-5130, or MIL-F-5572 in any sequence.

• **Pressure relief valve.** Model 11740 maintains external fuel tank pressure within required limits. Suitable for use with dry air, it is not affected by fuel. MIL-F-5534, MIL-H-5130 or MIL-F-5572 in any sequence. Manufacturer reports that the valve operates at 50 psi without external leakage.

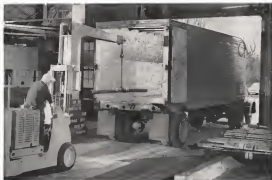


New Harness Tester for Turbojet Engines

The universal harness tester shown above has been placed on the market by Greer Hydramatic, Inc., located at International Airport in Jamaica, N. Y.

The tester provides a quick and accurate check of continuity, resistance, resistance, electrical shorts and short-to-ground in the electrical control system of turbojet engines.

The device consists of a low and high voltage test circuit, switches and controls for applying these potentials to the cable being tested and lights which indicate proper or faulty operation. The tester uses a 110-v., 60-cycle, single-phase power source and has no mechanical parts.



Order your size of TIMKEN® 52100 steel tubing today—we'll ship from mill stock tomorrow!

101 sizes of Timken® 52100 steel tubing are available in mill stock to take care of your rush hollow parts jobs. Order your size in lead-time-mill quantities today, and we'll ship within 24 hours.

Timken 52100 steel tubing is excellent for most of your high quality hollow parts jobs. It's a through-hardening steel in moderate sections. It can be heat treated to the hardness and tempered back to any desired point. And it can be used in place of more expensive steels.

Available in sizes from 1" to 10 1/2" O.D., Timken 52100 steel is used for hollow parts jobs like these:

aircraft parts, ball bearing races, pump parts and plungers, rollers, bushings, spindles, grinding machine parts, precision instruments, and dozens of other jobs.

The Timken Company is America's premier producer of 52100 tubing. And we're the only company that makes 52100 steel as tubing, bars and wire. Our unequaled experience insures you of uniform quality from tube to tube and heat to heat.

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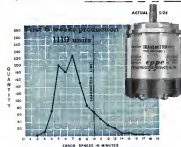
TIMKEN
Fine Alloy
STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CLIFTON PRECISION OFFERS A SIZE 15 SYNCHRO TRANSMITTER identical to BuOrd type 15CX4a

Except

ACCURACY SPREAD GUARANTEED 10' or LESS



The CG-15-M5-1 transmitter is interchangeable part for part with the U.S. Navy Bureau of Ordnance type 15CX4a synchro transmitter (Mark 22 Mod. 3) in every respect.

Because of quality workmanship in this unit we are able to guarantee accuracy spreads not to exceed 12'. From the chart it will be noted the majority of production units have error spreads between 5' and 6'—all prices remain accordingly low.

Stainless steel bearings are provided for better environmental resistance.

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New England: The Denbury Corp., 89 Elm St., W. Newton 63, Mass.
Southeast: Amerson & Woods Assn., 4143 Glenwood Lane, Dallas, Tex.
West Coast: Enright Engineering Co., 581 W. Kensington Rd., Los Angeles
Home Office: T. W. Shoop, Sales Mgr., Telephone (Phila.) MAckinn 6-2048

LOOK TO CPFC FOR SYNCHRO PROGRESS

CLIFTON PRECISION PRODUCTS CO. INC.

CLIFTON HEIGHTS
PENNSYLVANIA



PRODUCTION BRIEFING

►Berry Controls Inc., Woburn, Mass., has licensed Fritz Brenner, Glensidehouse 711, Roseland, Conn., to produce and sell its products. Among the products to be produced in Germany are isolators for mobile electronic instruments and Lexing Berry sensors, self-heating auxiliary mounts.

►Stanton Div. of Fairchild Engine & Airplane Corp. will establish a commercial products plant in October in Balaclava, L. I., N. Y. Products to be manufactured will include pneumatic controls, valves.

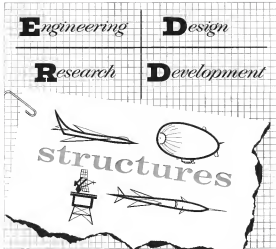
►Van der Blom Corp. will establish plant facilities in Chicago. The new plant will provide for a 45,000-sq-ft floor planing capacity. Production is expected to start early in 1978.

►Feldner Instrument Division, Robertshaw Industries Controls Co., has opened a western regional sales engineering office at 5180 Imperial Highway, Longwood, Calif., under the supervision of Charles J. O'Leary.

►Goodyear Aerospace, North Hollywood, Calif., has been awarded exclusive representation of Photo-Sonar data recording cameras. Now used at White Sands, Naval Air Materiel Test Center, the Air Force Flight Test Center, NACA, Langley and other military facilities, the specialized Photo-Sonar cameras have been used in aeromedical research and development since their introduction a year ago.



►MULTIPLE SPINDEL automatic lathe turning Smau, covering 12 sq. ft. of floor space, has reduced drilling time on a massive, difficult-to-machine casting from 20 hours to 45 minutes at Norfolk Aircraft, Inc. Built to Norfolk specifications by the Angle Corporation Co., Greenville, Calif., for the F105 Scorpion, the machine makes both rough and finish cuts in a single pass of the turning bars.



Structural engineers will find real scope and diversification at Goodyear Aircraft—where completely new aircraft configurations, utilizing a host of new weight-saving materials, are among the interesting assignments.

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In virtually any engineering specialty, a challenging and bright future awaits creative men who come to Goodyear Aircraft—where missiles, jets, helicopters, simulators and radar structures take shape.

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AUTOMATIC MACHINE bores and turns both ends of forward section in diameter and length and drills drive hole. Operator may be satisfied he looks and smells only.

Tank Line Goes Semi-Automatic

Parkway Aviation has set a production rate of one jet-suitable fuel tank every 4 min for its new Los Angeles plant.

To achieve this rate, the facility will make use of semi-automatic apert tooling, handling equipment and gaging and nuclear controls. Tank

sections are rolled into conical or cylindrical shapes in the first production operation, then connected to the line welder which makes the longitudinal seam.

After the weld is rolled flat to produce uniform thickness, the center section goes to a sub-assembly area

where bulkheads and external structures are installed, tail and wing sections go to large finishing machines.

Noise and tail skins are trimmed in special machines to produce true surfaces for the subsequent joining operation.

Then sheet metal openings for the nose and tail cones close to the line, where automatic Hydroarc machines weld them in nose and aft sections. After two special welding machines join aft and center sections, tanks are ready for a pressure check, fitting and disassembly back to a track.

Parts such as bulkheads, automatics and other sheet metal, cast and forged parts are fabricated outside the special assembly area and then are stockpiled in stock rooms adjacent to the assembly line.

The room, assembly facility occupies about 50 acres, working in a 360/30-ft area.

Hydrant System Fuels B-52s at Seattle

USAF B-57 bombers at Boeing Field, Seattle, can be refueled from hydrant fuel at a rate as fast as one per the world's largest and fastest filling station.

Fuel for the night-stay bombers is stored in three 46,000-gal underground tanks.

Three 75-lb. pumps can push the jet fuel through filters and water up arteries at 1200 gpm into a nozzle-held which serves all the ground-level hydrants.

Fuel flow, which can be stopped, is push-button controlled. Rows of water-gate valves are set just below the level of the concrete to prevent the spread of fire.

USAF Gets First Supersonic Simulator

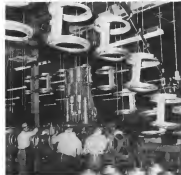
The Air Force has gotten its first flight simulator for a supersonic plane, with delivery to Natick AFB, Mass., of a unit for the North American F-108A Super Sabre. A second unit will be delivered next.

Several simulators for Convair's intercept F-102A are slated for early installation at Tyndall AFB, Fla. (AW Feb. 4, p. 90).

The F-108A simulator was developed by McJannet Inc., Alexandria, Va., under supervision of Wright Air Development Center's Equipment Lab.

It required 15 months to complete the simulator from the aerial design through final construction.

The unit's weight is 13 tons. It takes 38.5 kw of power to run and includes 45 km air conditioning capacity.



BULKHEADS AND UPPER INTERCOSTAL are mounted on rolling fixtures. Fuel holes are accurately drilled simultaneously in the assembly in sync with the support drilling.

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Extensive testing proves that the Safety L/B Screw offers the most accurate, reliable, and efficient means of actuating a missile's guidance system. Its unique design and construction make it the only L/B Screw that can be used in any guidance system.

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By requiring only 1/10 as much power as a conventional screw drive, the Safety L/B Screw offers the most efficient, reliable, and efficient means of actuating a missile's guidance system. Its unique design and construction make it the only L/B Screw that can be used in any guidance system.

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Because the Safety L/B Screw is made of hardened steel, it offers the most durable, reliable, and efficient means of actuating a missile's guidance system. Its unique design and construction make it the only L/B Screw that can be used in any guidance system.

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OPERATIONS ENGINEERS

Concurrent with the establishment of a Military Relations Department at the Fairchild Aircraft Division, an Operations Engineering organization has been established. The purpose of this new group is to provide technical information for use by Fairchild Military Relations representatives, as well as by personnel at Fairchild's engineering departments. This new group will conduct studies on specific Fairchild airplanes, as well as system studies relating to possible future Fairchild developments.

The scope of this organization is such that additional engineers are required in the following fields:

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AMC Announces Staff Changes

Denver—Air Materiel Command has reassigned three staff officers and eight technical officers in the Directorate of Procurement and Production.

The staff reassignments are:

• Col. Richard B. Uble is Assistant Deputy Director of Procurement, succeeding Col. Lee W. Talbot, recently transferred to Baltimore. Col. Frances Hengster succeeds Col. Uble as chief of the Programs and Analysis Office.

• Col. John B. Dick is Assistant Deputy Director of Production, the position formerly held by Col. Louis H. Garrett, who is transferring to Middle Tennessee (R). As Materiel Area, an Assistant Deputy Director of Production.

• Col. Ralph H. Schuler has been named Deputy Director of Mobilization, succeeding Col. Joe Dowd.

The eight operational assignments are:

• Col. Francis J. Carr is chief of the Support Division, coming from Headquarters, USAF, where he was Deputy Assistant for Materiel Services.

• Col. Philip Kark, technical assistant for production engineering in the Industrial Resources Division, comes from Headquarters, USAF, where he was chief of the Industrial Equipment Branch.

• Lt. Col. Donald A. Skene, Jr., new chief of the Industrial Support Section in the Industrial Resources Division, has been assigned to AMC since 1972. He succeeds Col. William J. Adams, who has transferred to the Philadelphia Air Procurement District.

• Lt. Col. Wallace S. Martin, chief of the Weapon Services Staff Division, is now division that will act as the world wide AMC local point for the Air Force and industry in matters pertaining to weapon systems management. Col. Martin has been with AMC since September 1951.

• Col. Marshall J. Wetzel, chief of the Research Branch in the Armaments Division, comes to AMC from the National War College, succeeds Col. Martin.

• Col. Leonard E. Smoraski, chief of the Nuclear Services Branch of the Armaments Division, formerly was a student at the Naval Air College. He succeeds Col. R. J. Iverson.

• Col. Elmer M. Hulse, chief of the Metals Branch of the Armaments Division, comes to AMC after spending two years in Okinawa.

• Col. Isaac M. Lasky, commander of the Armaments Division. He has been at AMC since March 1951.

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newest, least understood super alloys. Through close integration between laboratory and factory, this knowledge becomes a basic part of aircraft production know-how.

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CAL Works to Adjust Man to Supersonic

Supersonic man has been thrust into the supersonic era, and the current nature of the man is now the evolution of the machine has outstripped his man. man has become dependent upon a new realm of research and development, a technology that has come to be known as human factors engineering.

As the name implies, it is a research process designed to make man compatible with the machine. And it has been up to the military to take over the leadership in the field, to provide the funds, the paper work, the program and, finally, the "personnel" to test the critical equipment under actual conditions.

Many of the answers needed to keep man alive in the new era have been provided by universities and private research laboratories working under military sponsorship. Typical of such work is the research being carried on at the Cornell Aeronautical Laboratory, Inc., of Ithaca, N. Y., a fairly new device is in use right at the moment of the laboratory's work, prepared for Aviation Week by a CAL staff member, follows:

The studies of Cornell Aeronautical Laboratory, Inc., can be divided into three basic groups: planning (of the pilot), comfort and safety. When included head impact investigation, automobile passenger releases, supersonic cockpit studies, development of padding materials, evaluation of human wearability (harness), etc. crashes and survival testing.

Basic to human engineering development is the provision of a suitable "work environment." Obviously, studies of human behavior in flight should begin with studies of living life and preventing injury.

Research has shown that there are at least four fatalities result from head injuries. Head impact studies at Cornell Aeronautical Laboratory for the Medical Research Division of the Office of Naval Research gave three definite conclusions:

- The head will be critically injured in a crash against a flat rigid surface at an average impact energy of about 600 ft/lb (60 inches multiplied by 10 pounds).
- If low density, energy-absorbing materials are used at padding outside on the crash surface, the head can take impact five times greater than if crash surfaces are not so padded.
- Surfaces which the head may strike in a crash should be four characteristics: they should be flat with large radius of curvature, rigid enough to help support the head but deform under impact, smooth with no sharp edges,

delivered so as to provide as large a contact surface as possible.

To prevent pilots from losing consciousness in a crash, CAL studied existing helmets and offered a new design. The basic pad helmet which acts as a base to distribute the force of a blow over a wide area of the wearer's head and acts as a soft cushion for comfort.

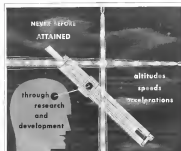
A unique feature was a goggle suspension system. This consisted of a strap arrangement to cradle the helmet on the head so that, regardless of the angle of a blow, the helmet does not "bottom" against the head in a crash.

Accident prevention and insurance of pilots when accidents do occur was another phase of such research. CAL engineers used test equipment consisting of a typical, light weight ratio and dynamic dynamometer system to human counterparts.

A detailed analysis between the effects of seat and phase crashes had previously been noted. In most cases, findings have as applicable to aviation.

Accident Movements

Tests showed that movement of vehicle occupants in the front seat during crashes are predictable. First,



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two rotation about the top joint is followed by an acceleration of the body upward and forward at about a 45° angle to the vehicle.

After the body strikes the vehicle surface, the test personnel depends on specific test conditions. The driver consistently adduces a clear blow against the steering wheel and a head blow against the upper windshield at subsequent modeling.

Knowledge of these motion characteristics in crashes has been a great aid to engineers in developing safety devices. However, safety in aviation is a complex of many factors. Because takeoffs and landings, for instance, can be dangerous maneuvers, mechanical pilot aids, such as the instrument landing system (ILS) are expedient.

CAL, under an aerial research grant, developed a system known as lateral guidance to be used in conjunction with ILS. This system from the pilot's visual attention from his array of instruments by giving him some auditory signal through ear phones. It can guide him through vertical and lateral flight, in take-off and approaches when the visual stream is jammed.

Recent guidance continues with visual advantage guidance systems in this respect the pilot flies over from the side to reach base point. For instance, in lateral lateral guidance, he turns right when the signal is present in his left ear.

The of lateral system also was suggested in a study of blood landing systems which the laboratory projected in evaluating needs for an automatic carrier landing system, the visual take-down procedure-coupled with a single source of frequent beamed evictions were suggested as a means for the aircraft to approach the carrier safely.

Automatic carrier landing systems and its aspects cannot be entirely applied to aircraft carriers since the carrier's variable landing area is small and unstable. This investigation outlined some problems that have to be considered in development of automatic carrier landing systems. Traffic patterns, radio equipment, antenna distribution, computers, safety devices and the guidance data technique just mentioned.

Lessening the effects of accelerations on the pilot is one of the greatest problems human engineers must solve. In 1946, one of the laboratory's pioneer efforts for the Aero-Medical Laboratory, Wright Field, was the development of equipment which would produce ergonomic factor on the human body and enable engineers to study the physiological reactions of the pilot. Known as a device, it was a controlled reac-

tion of simulating crash landings or violent maneuvers.

Comparative physiological studies were possible with this equipment. Data final reactions were recorded by a high speed camera mounted inside the test cell.

Three years later, experimental pilot equipment to produce rapid acceleration was developed. The equipment was chiefly concerned with a cockpit in modeling one whose intensity about a final run was to be carefully controlled.

Supersonic Cockpit Study

Another study of significance in the human engineering field was the super-

sonic cockpit study. The Special Devices Group, Office of Naval Research, contracted with CAL, early in 1947 to look into human factors in supersonic cockpit configurations. The result was a monumental report titled the Aero-Medical and Engineering Physics Departments of CAL and the Cornell University Medical College in New York City. The project report, written as a guidebook for aircraft designers, is a compilation of articles and reports and evolution of the physical and psychological reaction to supersonic flight.

This project has since been revised and expanded to include research data

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obtained from aircraft ejection seats. This material is used today in research departments of most aircraft and aircraft equipment manufacturers.

Some new aircraft designs were considered adequate at the pilot's initial safety. Criteria changes in very high or low temperatures, poor vision, poor instrument, hypoxia (lack of oxygen), low-level pilot efficiency at high speed and altitude. Mounting pilot complaints finally gave rise to complete re-evaluation of known factors involved in flight.

CAL's supersonic cockpit report covers temperature environment, controllability of the plane, emergency escape, effects of acceleration, noise, equipment arrangement, vision, pressure, cosmic rays, etc.

Counting or timing two strategies employed to prevent effects of acceleration, are now believed to cause restricted due to early fatigue. Force or space position in VTOL aircraft may cause further damage from shock if power failure or cabin jettisoning occurs.

An automatic, reliable anti-G seat, controlled by an aircraft's altitude meter, was recommended as a possible answer to the acceleration problem in this report for the Office of Naval Research.



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Assigning responsibility is a repetitive task in an emergency. In a supersonic flight, the pilot must assemble and interpret data from instruments faster than ever before. Greater distances are covered in a shorter time. However, he may be in an uncomfortable position.

If he is in a position of severe position to take the stress of high speeds, he must work area may have to be managed. Because of requirements, instruments should take up the least possible space and still be readable. The number of instruments should be minimized, but emergency escape should be considered as one of the most important pilot's job most difficult.

Also more work on cabin area is needed, and the reliable seat design, possibly restricted in a matter of helping the pilot through the effects of speed, must be given more detailed study.

The Pilot and Temperature

Another pilot consideration, temperature environment, was studied in two phases: heat and cold level tolerance and the pilot's psychological and physiological response to temperature.

The pilot handles his ship with a certain level of heat and cold, even though physically he may be able to stand that level. So consideration had to be given to both the physiological and psychological temperature factors.

As flight speeds increase, temperature rise in the boundaries layer (near the plane's surface) that flows in the cabin wall and then is transmitted to the cabin area which is not insulated as the cockpit.

An infrared cooling system to regulate cabin air through the cabin, into the space between two layers of insulation in the wall and then discharging it to the outside, is discussed in the report.

Emergency escape is another complex problem in supersonic speeds. Parachute and ejection seat escape may cause a serious opening pit, lack of oxygen, burns or frostbite during descent.

The extreme air velocity which hits the escaping pilot may cause him to lose consciousness. The opening pit in a parachute is three and one-half times greater at 40,000 feet than at 10,000 feet. If a man does survive this initial shock, he may either freeze during the descent or run out of oxygen.

Heat emergency escape problems were considered in an evaluation of a jettable escape, such as the cabin itself. As long as the cabin wall of the jettable escape is not ruptured, the cabin air will have adequate oxygen.



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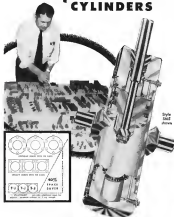
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and the cabin itself will prevent excessive and dangerous variations in temperature during the fall.

Limitations of the capsule also are discussed, difficulty in slowing the aircraft on approach, stabilizing the cabin during descent, decelerating the cabin before pilot escape or landing.

Air Pressure

Air pressure poses a particular problem in supersonic flight. Pressure decreases with increase in altitude. Man needs sufficient pressure to prevent oxygen absorption through lung capillaries into the blood stream. Therefore, some level of pressurized cabin to maintain pressure must be used in supersonic or high altitude flight.

However, a completely pressurized cabin presents the possibility of explosive decompression and a ruptured cabin wall. Since rapid descent to prevent loss of oxygen is precluded by high altitude requirements of rapid ascent, planes and self-sealing walls and auxiliary air equipment are required, it was concluded that partially pressurized cabins, partial pressure suits and pressure breathing equipment provide the best emergency measures.

Many CAL studies have followed through on the supersonic cockpit project.

Controlability, a significant part of the project, today is recognized as a new for laboratory work.

Aircraft Controls

The first airplane controls were rudimentary and a stick. Today, controls are highly complex. The laborer has devised a means of taking action on him to control systems to ease the pilot's burden.

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BUSINESS FLYING

N.J. Firm Begins New Program For Leasing Twin-Engine Planes

Aero Lease Plan Inc., of Linden Airport, N. J., recently began a new two-engine aircraft dry-lease plan designed to fit the requirements of small corporations after unwilling to make heavy capital investments or waiting to obtain a qualified operating experience before deciding on ownership.

The initial success of the program, Aero reports, has been such that several additional aircraft will be added to the fleet before more than the next several weeks.

Basically, the lease provides for 30-day use of a Beech C-44 or 580C, including full insurance. Other charges include airport entry, fuel, maintenance and liability insurance, as borne by the lessee. There also is a charge of four dollars per engine hour which is applied against the engine overhaul at 600 hr.

Another requirement is that the customer perform 100-hr checks on the airplane. During the term of the lease the customer can fly the airplane any number of hours or less at an place he chooses without affecting the base 580 rate.

The customer is permitted to modify the airplane's exterior if he desires and to install additional or supplementary equipment which can be removed when the aircraft is returned. In some cases, Aero may also purchase the installed equipment if it enhances the plane's leasing value.

If the lease takes a plane for one year, a portion of the wet rental-gross rental minus full insurance—is applied to the airplane's market price, which is agreed upon when the contract is signed.

First Aero, president of the leasing firm, told Aviation Week that he considered the venture after encountering and resistance in selling multi-engine equipment to small concerns, particularly those without corporate aircraft experience. Such companies want to feel they were into the operation without making a heavy commitment for something they may not need or want. A purpose to be an airplane might also meet and opposition from the board of directors or stockholders. However, if an airplane can be leased and operating experience gained, the chance of an eventual sale are increased.

Other opportunities include the leasing of planes to firms with heavy seasonal travel periods and during sales conventions when many companies have to move a large number of personnel from various locations to the meeting site and then back again.

The lease currently has five planes on its list: two Beech C-44s, a Continental-powered D15 which leases for \$1,300 a month, a six Hovland Dose at \$1,750 a month and a Lockheed PV-4 Ventura for \$1,600 a month.

The PV-4 Venturas is being presently offered by Aero only on the basis of a

short-term minimum lease agreement. Those of the Twin Beeches are currently working one in Canada, another in California and the third with a firm handling cargo charter for a large corporation.

Aero expects to concentrate on the twin Beech in leasing operations and develop this operation much in Los Angeles and in Miami. Aero spokesman in DC is Leonard, reportedly now has more than two dozen DC-3s on lease, but the eventual composition of the Aero fleet will depend upon customer preferences.

Aero also admits that the venture, begun in mid-August, is still largely experimental and that he has much to learn about the problems involved—the aspects of industry that will prove to be the most effective market, how the aircraft will handle the planes, the type planes that will meet and the last equipment for the job.



Converted Convair L-13A

The eight-passenger Convair L-13A shown here has been converted from a Convair L-13A to a cargo plane by the Aeroquip Corporation. The plane can be converted into a cargo transporter by removing the seats. It is powered by a Lycoming O-435 150 hp engine.



Leading gear of the new delta-wing General Dynamics F-16A is shown extended in this test flight takeoff. The new Air Force interceptor, designed to fly day or night—in any kind of weather, sustained the speed of sound in level flight in record time in the air.

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Pleasure Flyers Lead In 1954 Accidents

Pleasure flying accounted for the greatest number of non-carry small-plane accidents in 1954 according to a detailed Civil Aeronautics Administration survey.

Of the 3,018 accidents in this category, pleasure fliers accounted for 1,474-199 of which were fatal and produced a death toll of 349. The survey does not include agricultural flying accidents which will be dealt with in a later study.

Colleges, mostly on the ground, spent on stalls and ground loops ranked in the top three causes of light-plane accidents last year, according to the CAA. They accounted for 638, 561 and 497 accidents respectively. Spin and stalls ranked highest in the cause of fatalities, with 197 deaths or 36.1% of the total.

Most common cause factor resulting in accidents and fatalities proved to be the weather, which took the blame for 597 accidents. According to place of operation, accidents during landing totaled 1,181, in flight 797, takeoff 956, and turning 197.

Flight Safety Group To Aid Business Flyers

The Flight Safety Foundation is organizing strong backing from corporate aircraft owners for its new program of providing technical guidance and liaison for business fliers on important operational and safety problems.

Since these private corporations al-



YVH in 302 four motor, above, will become Germany's first postwar production aircraft. Tests begin next year.

ready have made financial contributions to help FST expand its new services, as FST executives told Aviation Week. The Foundation tentatively plans to hold its first forum for business pilots and aviation executives next month. The meeting place has not yet been determined but the landing conference is planned for New York and Cleveland.

The new department reflects information from corporations on operating procedures, maintenance problems, mechanical troubles and their remedies. The material is compiled and evaluated among business fliers for their protection. Also FST, with its numerous

contacts with industry, military and governmental agencies, can keep members posted on developments relating to their operations using material collected as a result of its council advisory functions.

A corporation pilot told Aviation Week that there has long been a need for such a "clearing house" that would guide business plane users, particularly in maintenance, safety and operating procedures. "We used to get a lot of help from our friends in the industry," he said, "but now they are flying newer and faster equipment and they don't have the same problems anymore." He noted that corporations then had tried

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Model HZ-1 Horizon Flight Director is a pictorial horizon with conventional scales, effectively combined with the well-known Sperry Zero Reader* Flight Director. The non-tumbling horizon is graduated to $\pm 90^\circ$ in pitch from level flight and provides pitch and roll attitude information at all times while

flying "zero" on the Flight Director. When not in use the Flight Director pointer can be retracted from view.

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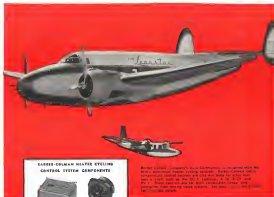
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unavoidably to exist the end of several operations in the process.

When the nation manager of a large corporation selected the proposed to the Flight Safety Foundation, it seemed immediate and enthusiastic response from managing director Joseph L. Lohr who had been thinking along the same lines for some time. The job is still has been assigned to Donald H. Carpenter, manager of FSA's Air Transport Division and an associate of the company in an American Airlines captain. The activity is based at the Foundation's headquarters, 471 Park Ave., New York City.

Caperton and the activity will continue a central stand by companies about new equipment. It will, however, check the requirements for each equipment and pass them along to the personnel

used for in evaluating available types. The foundation also can establish contact with manufacturers for business plane users to special problems. Companies mentioned one case where a corporation wanted to replace the de-ice system it was using with something more modern. However, the type it wanted was not yet commercially available.

Through FSE, the corporation obtained the necessary drawings and specifications and had the equipment made by another firm.

Flight Safety Bulletins

An safety bulletin index for 1954 including known pilots' notes, is being issued by Flight Safety Foundation Inc., 471 Park Ave., New York 17, N. Y.



C-123 Begins Suitability Tests

Four C-123 aircraft transport on down road leading through a 1000-foot tunnel in approval suitability tests are being at the Texas Training Command, Eglin Air Force Base, Fla. The C-123 is designed to land and take off in front line, even on short unimproved runways, bringing in supplies and evacuating the wounded.

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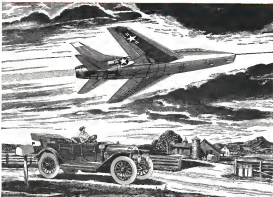
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PRIVATE LINES

When '58 twin-engine Norton aircraft was tested across the North Atlantic by Fleetway Flying Service with a record fuel load. One change was the addition of some low-frequency transacting and receiving equipment. The twin Norton was produced by the General Tool & Airco Corp. of America for a subsidiary—the Conquest Co., of Zurich, Switzerland.

Bladder fuel cells in center section and outer wings and a sophisticated piping system are features of a Precision Tool & Rubber Co. Lockheed Lashuta which was completed by Vernon-Gervin, Tex. This is the first of several Precision Toolblasts to get the new features.

Scintillation Counter SC1820A for airborne use in testing systems for wire bond bond documentation against high and low capacitance for fast dual optical selection and workmanship logging of absolute absolute and counting rate with dual memory. Rates of 200 events/sec. per measurement for and higher are stated to be available. Mt. Super Industries Corp., 1170 Ford St., Boulder, Colo.

North American Van Lines, Inc., Ft. Worth, Tex., has purchased a Beech Super 18 to replace an earlier Beech Comquest. President James D. Edgett says the fleet approximately 5,000 in a month in the firm's place. Harold S. Vandehey has purchased a 12-place Learjet equipped for long cross flights.

Rider installation developed for Learjet is expected to improve the learner plane's aerodynamic characteristics and increase cruise speed by several miles per hour. Lear Aircraft Engineering Division, Santa Monica, Calif., reports Transonic research is completed as a preventive control of noise and air resistance at the moment to hold length of wingtip to a few inches for maximum signal loss. Lear has two Learjets in the shop, getting the stabilizers using Bendix RUX III X Band with Ruxon Station plotting. In stabilizers is also applicable to Lockheed, Vought and Lockheed, Lear notes, and it expects to make a field test available soon.

Aircraft development plans for Denver's Stephen Airfield is being studied by city officials. The proposed site is approximately 54 miles from the 1960-57 million for various extensions and

NEW Model 34128 Rate Gyro is a rugged, medium size, self-contained, designed for aircraft and aircraft control or instrumentation. This high accuracy instrument is enclosed in a hermetically sealed case and is continuously available with minimum thermally controlled heat sink design for constant damping over a wide range of environmental temperatures. The gyro operates from a 1 phase 60 cycle power source (100, 115V, 200V), and is available with either a stable metal pressure pot or ceramic pot. High level electrical output proportional to angular velocity are available from either potentiometer or can be used directly for recording, control, or as low amp. pickups, with little or no amplification. This instrument is available in a wide variety of speed ranges of 15 to 100 degrees per second and with damping ratios between .85 and .95 of critical. Built in mechanical damp prevent excessive g-forces from being applied and prevent damage due to vibration beyond rated range. Worn out or plug can be discarded at either end. Because the inner mechanism is floated in oil, this gyro is capable of operating under extreme conditions of vibration and shock, from 2 g's to 25 g's, from

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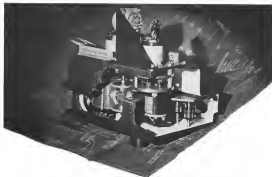


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Congestion at the Gas Station

F-4B Navy jet fighters "line up" behind AJ "Savage" tankers over F-4C Phantom IIIs head of the Museum Naval Air Station, San Diego, completes its qualification flight as it taxis refueling. In qualifying all its pilots in line of the museum, the squadron selected only one aircraft. A pilot was selected for F-4B when the line stopped at a point between the jet and tanker. With 40 lb of hose in tow, the officer managed a successful landing.

CAA Plans to Give Air Industry Greater Say in Safety Regulations

Washington—The Civil Aeronautics Administration plans to place additional responsibility on the aircraft industry for compliance with safety standards and regulations and reflect its own activities in this field.

The CAA says there is no question but that some safety promotion and regulation activities can be eliminated, delegated or transferred to industry without adversely affecting the present high level of safety.

The future role of CAA is presently depicted as that of overseeing and advising the industry in good operating and safety practices while exercising only a supervisory action of compliance with safety.

The CAA proposes to delegate certain functions in the aviation safety field to responsible segments of industry as now being conducted by industry groups and trade associations. Industry representatives have been asked to meet with CAA officials for informal discussions prior to the submission of formal comments. This course of action was suggested under the proposed program is only a basis for discussions with industry.

The program is presented as the basis of a committee report by the

Office of Aviation Safety as "Industry Safety Responsibilities." The committee was appointed by Al S. Koch, Aviation Safety Director, to develop proposals to implement the President's budget savings in which the President said:

"With the increasing maturity of civil aviation, the federal government need not be able to reduce substantially its safety promotion and enforcement high level of safety. I have requested the study preparation of a plan, in cooperation with industry, to achieve this objective."

The committee consisted of W. H. Woods, Chief, Aviation Engineering, chairman; E. B. Franklin, Chief, Air Carrier Safety; E. W. Madison, Chief, General Safety; and E. W. R. Stewart, Chief, Medical Division. A final report was completed by the Woods Committee on June 15 but was held up at "administrative" reasons for two and a half months.

The report is broken down into four parts covering activities in each of the four divisions comprising the Office of Aviation Safety—Air Carrier, General Aviation, Engineering and Medical. In each area, it is proposed that certain functions be eliminated, delegated,

transferred or retained by CAA, in the case may be.

A majority of the various changes would require Civil Aeronautics Board approval, would necessitate legislation, while others could be administratively implemented. Recommendations of the committee are as follows:

Aircraft Engineering

CAA should not continue to make detailed and routine engineering checks of commercial products. This activity could be delegated and/or transferred to an industry which is now largely capable of making such determinations. Such action is necessary due to the far-reaching growth and associated complexity of the aviation industry which makes a corresponding increase in the size of CAA as these activities continuously requested.

It is believed that some of the basic aircraft engineering functions can be eliminated entirely but that there is room for "delegation" rather than "transfer" of responsibility. Leading items of proposed delegations lie in the area of type certifying of new aircraft.

Here it is proposed that the responsibility for proving compliance with Civil Air Regulations be delegated to "manufacturers of new regulations." This would also be true for engines and propellers.

Other aircraft engineering activities that a proposal to delegate include:

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IDEAL-AEROSMITH, INC.

12809 South Delta Avenue, Hawthorne, California

is also a great demand for the dissemination of the results of the research on Long Island. Our general understanding has been considerably enhanced at 15,000 children. During the summer months we have been able to visit the site of the accident and see the results of the research.

The other members of the RANM are made up of members like myself and I think the entire group will be in that we are going to have to work for a complete first class school in the south of the states.

It has been noted that there is a need for good three-year plan of the school which could be set in the very model. The RANM are presently engaged in a project of preparing a letter to the school describing the various Republic school and forming a set of drawings for use in building a new school model. The first of the school will be the P.O.C. and is scheduled for completion in the spring of next year.

I think we are all agreed that schools should do as much as it possible to form youth motion education and, therefore, sometimes we are going to compare them for not always going their way to the model program. We must remember that industry contributes to a large number of different types of program and of those related to forming a motion education.

Increasingly larger areas are being spent for education and other educational institutions all over the country in the engineering field and in other fields and many local programs are planned in part or in whole by the different schools and groups.

I am certainly not trying to take for the company, including Republic, but I am not to enter the area that our model program is not as yet in the production of motion, we are not the only one in advancing the "force".

My WALTER, President
Republic Airline School South
Pawnee, N. D.

Poor Airline Service

I would appreciate your pointing the finger, even though it has no direct bearing on my specific case.

It has been the experience of the reader that the service has been hampered by the airline on rate out of Chicago has deteriorated considerably. Whether this is due to the airlines being put on the "disaster" flight, or to the increased cost of fuel and other factors, I am not sure. I am sure that the airlines are not doing well in the current period of the year.

However, the fact remains that on a local flight, the service is going very poor and the airlines are not doing well in the current period of the year.

A recent experience with a local airline in the New York area on a local flight with the transportation around 70 degrees 50 people who on a local flight with a full load of passengers. The airline was not doing well in the current period of the year. The airline was not doing well in the current period of the year.

I am sure that if the flight had not been made for the airline, the airline would have been able to make the flight. The airline was not doing well in the current period of the year.

There is no way to make the flight. The airline was not doing well in the current period of the year. The airline was not doing well in the current period of the year.

service these months against whatever the airline provides.

There are many more airlines that are not doing well in the current period of the year. The airline was not doing well in the current period of the year.

It is true that the Civil Aeronautics Board pulled their heads out of the sand and indicated that the airline was not doing well in the current period of the year.

There are many more airlines that are not doing well in the current period of the year. The airline was not doing well in the current period of the year.

John R. Kelly, Jr.
John R. Kelly, Jr.

IN THE RIGHT CIRCLES

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THE O K TOOL COMPANY INC.
Mifflord, New Hampshire

WHO'S WHERE

(Continued from page 9)

D. Louis G. Dorn, director of the General Motors Research Division, General Motors Corp., Warrendale, Pa. 15090.

Anthony L. Frazzetta, training director for Texas Aircraft Corp., appointed vice president Region 3 of the Aerospace Society of America.

Jack E. Givens, sales director, Allegheny Airlines. Also promoted Capt. Harvey M. Thompson, director of operations, Lake Mead, director of maintenance, engineering and communications, Elbert County, special detail and assistant to president.

John E. Mapple, Gordon district operations manager, Trans World Airline, Grand Rapids, assistant district operations manager.

Robert Part, project engineer, certified project director, Aerospace Radio Corporation, Miami, Fla.

Ray J. Rennie, Detroit district manager, Ford Electric Co.

Donald R. Rennie, research engineer, Edison Research Laboratory of Thomas A. Edison Inc., West Orange, N. J.

Peter Macdonald, manager of Analysis Aircraft Corp.'s new Washington office.

Charles D. Goodwin, manager of analysis operations, special defense projects department, General Electric Co., Hartford, W. Conn.

Carl R. Hild, operations manager of Lucas Airlines.

Charles E. Erdreich, West Coast director of engineering and research for Union Corp.

J. R. Grogan, manager sales information, Avco, Inc., John Willard, senior project sales and service.

Joseph Holland, sales manager of military projects, AC Spark Plug Division of General Motors, Warren, Mich.

John F. Pennington, assistant sales manager of aircraft division, Eaton Manufacturing Co.

A. J. Jones, assistant to the general manager of the aircraft products division, Rex Development of Canada Ltd.

John F. Pennington, assistant sales manager of aircraft division, Eaton Manufacturing Co.

A. A. Camp, sales manager, Allied Research Sales Corp.

Richard Finkle, manager of the West Coast engineering field sales, Foster Aero Services Co.

Walter D. Selzer, product sales manager, Leach Sales Division of Leach Corp.

Donald D. O'Brien, director of systems systems planning, Bendix Aviation Corp.

A. E. Ellison, chief designer for development of P-1 aircraft, Taylor, English, Torrance Co. Ltd., Warren, Louisiana, England.

F. D. Crow, chief designer for the Carlson

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Memorandum No. 17, Superior Tube Co., 1746 Greenstone Ave., Norristown, Pa.

A Guide to Specialty Steels, booklet, Carpenter Steel Co., 519 W. Ben St., Reading, Pa. . . . Selected Scientific and Engineering Tables and Data, booklet, United States Printing Co., Inc., 1415 Park Ave., Hightstown, N. J. . . . Engineering data on versatile steel and self-erecting G-rop, brochure, United Metalliferous O-Ring Dept., Box 1075, Dayton 1, Ohio. . . . Operating advantages of Hytrec Measurement Belt truck are described in Catalog Form No. 1482, Elbert Co., 2502 N. E. Chisholm St., Portland, Ore., or 1017 Myers St., Detroit, MI.

Products for Plastics Reinforcement, booklet, Owens-Corning Fiberglas Corp., Textile Products Div., 596 Madison Ave., New York 22, N. Y. . . . Load capacities, design standards and considerations of beams, bulk storage, handling, Beaver Products Products Inc., 619 N. Rochester Rd., Chicago, Mich. . . . Color Slide Sequences in Audio in Business and Education, pamphlet, No. 5-6 Sales Service, The Fashion Kiddie Co., Rochester 6, N. Y.

Publication Received

•Project Skyline, Cloud and Lightening Observation Handbook—by Paul D. McCord, Jr., Vincent J. Schaefer, John H. Durnach, J. S. Barnes—Available from Monthly Foundation, Inc., 130 Fifth Ave., New York 10, N. Y. 47 pp. Cloud-observation techniques.

•Marketing Kester Aluminums With Automobile Service Machines—Pub. by Kester Aluminums & Chemical Sales, Inc.—Available upon request to Technical Editor, Kester Aluminums & Chemical Sales, Inc., 210 North LaSalle St., Chicago 1, Ill. 52 pp. Technical data and trading information.

•Proceedings of the Symposium on Printed Circuits—Pub. by Engineering Publishers, CPO Box 1151, New York 1, N. Y. \$5.00 (12 pp.). Full volume of the technical papers presented at the 1955 Symposium on Printed Circuits sponsored by the Engineering Department of Radio Electronics Television Manufacturers Assn. with the participation of the Professional Group on Production Techniques of the Institute of Radio Engineers.

•Research Manual—Prepared by American Welding Society—Pub. by Research Publishing Corp., 430 Park Ave., New York 22, N. Y. \$4.75 (95 pp.). Hand book of bearing for metal-producing or metal-using industries.



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Pan American Spirit-Clipper stands at Honolulu, Hawaii. General Electric engineered electric system on this and other Pan American Clipper planes plays important part in ensuring comfort, and confidence in service.

HOW PAN AMERICAN IMPROVES AIRCRAFT



Located in nose of Spirit-Clipper, G-E generator panel helps assure electric system reliability.



Arrangement of G-E circuit breakers shows high accessibility—an important part of Pan American's program for easier maintenance of electric systems.



At Pan American's service shops, G-E field engineers assist in helping to improve reliability of electric equipment.

Long life of G-E aircraft generator has been achieved through improved brush design and bearings.

The new Douglas Super 7 Clipper makes service easier for Pan American's 30-5000-hour intervals. Aerial systems, representing 125 million dollars of flight, America's success with G-E electric systems led to Pan American specifying G-E for new fleet of "Super-7's."



ELECTRIC SYSTEM RELIABILITY

G-E design engineering combined with first class field service help Pan American increase life of power generating systems.

Dependability of Pan American World Airways' aircraft generating systems is the result of a continuous co-operative effort between General Electric and the airline to increase the life and reliable operation of the G-E components which help make up the system.

This reliability is essential Pan American's flights travel over jungle, desert, ocean, and rugged mountain terrain in all parts of the world. Any trouble associated in the plane's electric system could mean time-consuming delays or worse as fields. These could be costly to the airline and passengers.

G-E develops preventive system

To meet such problems before they occurred, Pan Amer now relies on General Electric to work closely with them and the airline's maintenance. Conferences were held, and G-E application engineers designed and demonstrated a generator protective system, which fulfilled all the requirements. So successful was this system that a duplicate

one was installed on Pan American's new DC-8's and DC-7's aircraft.

At the same time these engineering studies were being made, G-E united on a continuous field service to assist Pan American's overhaul shops in improving the component performance of the systems. This field service continues with the airline in still operating today. The result—the G-E electric system has given Pan American the increased safety protection to service demands, as well as better operating performance. That's why they are specifying G-E generator systems on new aircraft purchases.

Service available to you

G-E application and field service engineers can help solve your electric system requirements regardless of where you are located. For further information, contact your G-E Account Specialist through your nearest G-E Application Sales representative today. General Electric Company, Schenectady 5, N. Y.

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BOeing B-47, B-47T bomber, at the Georgia Division, Lockheed Aircraft Corp., Marietta, Georgia, serviced by G-E Frequency Changer Package that supplies ground power for testing of electrical control and equipment for radar, radio, and electrical systems.

LOCKHEED AIRCRAFT CORPORATION REPORTS . . .

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43 G-E FREQUENCY CHANGERS NOW IN USE AT MARIETTA, GEORGIA PLANT

Four years ago, Lockheed's Design Division purchased their first G-E frequency changer. They were looking for a portable ground power unit to furnish 480 cycle current with close voltage regulation and complete reliability. Results were so satisfactory with this first unit that they immediately placed an order for 20 additional units. Since then, General Electric has delivered 31 more Frequency Changers to Lockheed, bringing the total in use at Marietta to 43. They are used in the laboratory developing and testing new devices on the factory floor where manufacturing, assembly, and modifications are in progress, and on the flight line for checking instruments and electronic equipment.

V. G. CAMPBELL, ELECTRONIC STAFF SPECIALIST AT LOCKHEED says, "We have found in G-E Frequency Changers the high degree of accuracy and complete reliability necessary in the assembly and testing of the B-47s which we are building for the Strategic Air Command of the U.S. Air Force."

PIONEERS IN DEVELOPING AND MANUFACTURING aviation equipment and ground power supplies, General Electric is prepared to help solve your problems. G-E Aviation Specialists are ready to assist you by specifying standard units which will serve your needs, or engineering proper equipment for specific conditions. For further information, contact your nearest G-E Apparatus Sales Office, or write General Electric Co., Section 814-3, Schenectady 5, New York.



G-E TOTALLY ENCLOSED MOTOR FOR GUIDED MISSILE WARHEAD FUZES, rated 500 hp, 4500 rpm, 24 volts dc for intermittent duty is discussed by (l to r) Dr. W. W. Eaton, Industrial Consultant, Dr. C. A. Crowley, Director of Engineering and Development Division, Given Manufacturing Company, and E. Flekle, Given's Chief Project Engineer, Engineering and Development Division.

G.E. adapts motor for missile warhead fuzes, helps Given Company meet deadline, cut costs

"When our Company was selected by the Protinay Arsenal for pilot production of fuzes for guided missile warheads," says Dr. C. A. Crowley, Director of Engineering and Development, Given Manufacturing Company, "we were confronted with a design that called for a specially built motor to be used for the fast gear train. Because of previous satisfaction, our first step was to consult General Electric."

"G-E engineers, working in co-operation with our own engineers, were successful in redesigning an existing G-E armature motor to our exact needs. This action not only helped us cut costs, but put us in production on schedule. We're sold on service like this," concludes Dr. Crowley.

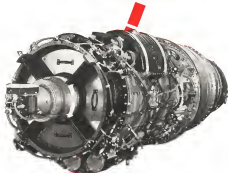
As a component of these guided missile warhead fuzes, the G-E motor is exposed to extremes of temperature from -85 to +150°F, and must stand severe vibrations and high humidity. As a part of G-E's development work, these conditions were simulated by G-E testing facilities, and the motor passed all tests.

TO SERVE YOU, General Electric offers engineering experience like that provided the Given Engineering and Development Division—experience gained through years of helping solve hundreds of difficult aircraft and armament motor problems. Contact your local G-E Apparatus Sales Office early in your planning. Or write giving details to Section 704-55, General Electric Company, Schenectady 5, N. Y.

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AVIATION SAFETY

CAB Report on Northeast Airlines' DC-3 Accident

Faulty ILS Descent Caused Crash

THE ACCIDENT

Northeast Airlines' Flight 703, a DC-3, N 17181, crashed during an instrument descent to the Berlin, N. H., airport on Nov. 30, 1954, about 11:15.

The first officer and a company flight representative, who was on the cockpit jump seat, were killed. The captain was severely injured, the stewardess and two of the three passengers were unharmed. The third passenger was later tested for injury.

HISTORY OF THE FLIGHT

Flight 703 originated at Boston, Mass., for Berlin, N. H., with stops at Concord and Lunenburg, N. H.

The crew consisted of Capt. W. R. Carey, First Officer George B. McCarthy, Steward Mary McFadden, and Flight Supervisor John C. McNulty.

Departure from Boston was at 0900 approximately on schedule, with a company clearance to Lunenburg under Visual Flight Rules. The first two segments of the flight Boston-Concord and Concord-Lunenburg, were routine.

Departure from Lunenburg was on schedule at 0909. The second segment had its usual two hours, its gross weight was considerable under the maximum allowable and its center of gravity was located within prescribed limits. Scheduled arrival at Berlin was 11:01.

A company pilot who identified the flight as reported on ILS clearance for the 71-nd flight, which was at that time reported by its company dispatcher at Boston and cleared for the CAA's Air Route Traffic Control Center, Boston ATIS, clear Northeast Flight 703 for an approach to the Berlin Airport.

Five miles to cross 5,800 feet.

At 11:01 the flight called the company station at the Berlin Airport and asked for local weather. The station agent immediately gave the 1000 observation. Estimated 5,000 feet overcast, visibility 2 1/2 miles, light was clear. The flight acknowledged but did not get in altitude and position.

The report then made a special weather observation at 11:03 and transmitted the following information to the flight: 2,000 scattered 5,000 overcast, visibility 2 1/2 miles, light was clear, and overcast 10 miles down to the north. (This was close to the Berlin maximum of 2,000 feet ceiling and 2 miles visibility.)

The flight's acknowledgment of this transmission was logged at 11:14, however, the actual time may have been as much as two minutes earlier as the report was slow and late. There was no further contact. No position report was received for North Country, a company request reporting must show position between Concord and Berlin.

At 11:25 the company's Berlin station asked for altitude regarding the flight. Accordingly, the Berlin operator called the flight at 11:28, but received no reply. At 11:30 the flight was still in the area.

At 11:30 the flight was still in the area. At 11:30 the flight was still in the area.

11:30 he sent a special weather report and requested that the flight return to Concord. Again there was no reply. (The weather had already changed.)

This special weather was called into service 1,500 feet below 3,000 feet overcast, visibility 2 miles, light was clear, overcast 10 miles southeast of the Berlin airport.

INVESTIGATION

Search activities were started when it was evident that the aircraft was down. Continuing low ceiling and snow rapidly hampered search.

About 0715 the following morning, Dec. 1, a message from the search was heard by the company's Berlin station. It was not

clearly or completely understood but indicated that the flight was down approximately five miles southeast of the field on a hill. The station agent immediately acknowledged the message which was not repeated by the search and search's certified company lead operator.

Search by ground parties and from the air was in progress in the prevailing bad weather would allow. Late in the afternoon of the same day ceiling and visibility improved and resumed search through the night. An search of the flight's station was possible the next morning, Dec. 2, when a North and South DC-3 sighted and identified the wreckage on the southeast slope of the hill some 15 miles southeast of the Berlin airport.

An Air Force helicopter had been standing by at Lunenburg, N.H., Massachusetts. N. H. It was flown to the crash site and a doctor was located. Survivors and the bodies of the two crew members were then flown to the Berlin Airport, one at a time.

In the meantime, based investigation had been initiated in the area showing the immediate start of an in the report wreckage.



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Use these blowers in cooling, heating or ventilating gas, vapors, oil-mist or oil-mist air delivery all rates in 750 cfm with a wide pressure range designed and engineered by a broad-based design firm. They are manufactured by PESCO under various license. You are assured all quality produced by the name PESCO—a long list of products of fuel pumps, hydraulic pumps and electric motors.

If you have an air delivery or exhaust problem, why not let the engineering and design of PESCO help solve it. You are invited to send your best PESCO sales response to write PESCO, 2470 North Main Road, Galesburg, Ohio.



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• SAFETY

ten. The first killing about one fourth mile away afforded a convenient site for many independent studies.

Witnesses testified that the last left eye came on several months before impact and all assembly, including the crew, left three balls behind. No mechanical support was sustained by the driver and the five passengers in the other. However, all three right eye members were thrown forward and McCoskey and McNulty received fatal injuries. Capt. Gary despite severe injury, reported several activities.

A fatal wound the left eye came on the second crash to rest. It was quickly put out with one and a half for the investigation.

Survival was the chief concern. Outside temperature was in the 40s during and after temperature was dropping fast. Oxygen tanks had to be used to ensure body heat, wrapping themselves with blankets, other insulation, including, certain, and each one, unexplained material, not clothing from baggage.

The following morning Capt. Gary was able to make a series of radio messages after experimenting with different frequencies and improved output. Only one message, generally understood, was heard. He also made his own position, some 100 miles ahead of the report, on an unexplained short. It was decided not to try talking out because of the lack of proper frequency and clothing, and also because the oxygen, the only one with any knowledge of the local geography, was fast being used.

Like that day the weather improved. Capt. Gary could see the coast and realized that his original position estimate was so error and that the coast was not northeast of the report in the vicinity of Mt. Sequoia. But the survivors were then decided and the radio could not be used. Filling troops had made several eyes were injured that evening and again, the survivors were among the Northwest Airline's search aircraft spotted the wreckage.

The search had struck the wooded and directly over covered wreckage of the aircraft, approximately 150 feet below the crest, at an elevation of 1,400 feet above sea level at the time.

Stripped around while the aircraft was on a heading of approximately 150 degrees and nearly level both before and subsequently. According to about 100 yards into a road that was probably at 40-50 yards making the ground level, 100 yards or less at impact. About the ground sloped up at an angle of some 30 degrees.

The aircraft crashed directly ahead through timber for only about 100 feet. No passengers were injured except the one was the greatest time of the crash itself.

From ten away the left wing tip, the left engine, and a large part of the right wing. The fuselage was bent to the right at the wing by some 15 degrees so that the forward portion was at a distance of 2 degrees, with the rear part at 35 degrees.

The cockpit was generally crushed and telescoped backward and upward but there was relatively little damage to the cabin.

World, Complete, Comprehensive Aviation Week Express, Seattle, Nov. 22

BIG WHEELS

and... little switches



Consider the LeTourneau machines shown here. In each case a team of big wheels works the master holding of little electric switches — a single operator at the end of any one of these giant moves is simple control and the machine instantly responds.

Each of the bag wheels drives, hauls, and can be stored — for each is a LeTourneau Electric Wheel, a new type of power package consisting of a LeTourneau Electric Motor and Gear Reduction within the rim of the wheel. These wheels from the bag wheel side have tires, which provide ground contact area up to 4 feet wide of each wheel for greater traction and less wear than any before. Removable, making operation possible in deep mud, powdery snow, or loose beach sand.

All functional operations of this new LeTourneau equipment are powered by LeTourneau Electric Motors, and controlled by the machine's single operator with simple electric switches.

This principle of electric power and control is a great new development which has increased machinery for the industry and increased production speeds for industry. It is a principle which LeTourneau can put to work for you immediately. May we be of help? Please, wire or write today.



LeTourneau electric wheel machine in operation. The machine is shown pulling a heavy load.



LeTourneau electric wheel machine in operation. The machine is shown pulling a heavy load.



LeTourneau electric wheel machine in operation. The machine is shown pulling a heavy load.



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project, allowing several of all other crew members.

The landing gear had been extended and locked before impact. Propeller pitch setting was 101 degrees 14 degrees right 101 to 15 degrees.

Post-impact control and instrument readings were checked. Both altimeters were set to 29.56 inches. The most accurate setting given the facts. The directional gyro read 150 degrees. The No. 1 engine in service was turned to 150 hp and its volume was set at approximately 75%. The Osmi (VOSE) source was set at 112.5 and its volume was 95%.

The No. 2 engine, however, ADB was turned to 250 hp and its volume was set at approximately 90%. The result of the ADB indicator had been to shut it out of the loop. The No. 2 engine, the one being used for ADB, was recovered from the, (over) and very thoroughly tested. No irregularity was found in the test or any of its components. The 250 hp, setting was gradually on the frequency of the engine (251 hp). The small difference would have been in no effect.

However, the loop and the loop having occurred on the outside of the engine was found out. The loop was not made and would have been a definite study of damage to the main drive gear indicated that the most probable loop during the time of impact was 150 degrees. This would have been a definite indication of a complete indication of 150 degrees.

The H facility in non-technical terms (as per the "loop") on the day the engine was ground checked on the day of the accident, both before (before) and after the crash and found to be operating normally. It was found that the engine was shut down when another aircraft, and also found to be operating normally. This became a big, only one irregularity factor at the Boeing Airport.

Capt. Cary stated, as indicated, that he checked to 5,000 feet altitude, as indicated in his decision, while in route to the Boeing. At the altitude he was above 5,000 feet, he was approximately 15 miles north of the airport. Beyond that point he was above a cloud covered. He had been using his ADB in obtaining a lot of time on the ground below and where above 5,000 feet in the city of Boeing, found it to be the frequency (251) of the Boeing Airport. Beyond that point he was above 5,000 feet.

He testified that he did not stay at 5,000 feet but stayed climbing altitude and the maximum in non-technical terms the segment of the flight would be considered the Boeing because in regard to the company's operations manual and as shown in his Japanese flight file, indicated he checked descent before reaching it.

The captain further testified, also in substance, that he entered the cockpit at an altitude of about 5,000 feet, and thought that he passed over the horizon, as shown by the second of his ADB words, at approximately 5,000 feet while in clouds, due, that he immediately started the pre-arrival landing procedure, being up to

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approved by the Administrator for the Boeing, N II, airport and the company's manual for guidance of pilots, called for maintaining 3,000 feet until overflying the Bello tower.

It is difficult to understand why Capt. Gray, at view of his long experience in flying 15 scheduled flights of Bello, as reported his clearance to go low rather than to descend when he did contrary to man-pair requirements.

According to the Flight Information Manual, the term "clearance" refers to "instructions" that must not be considered as the pilot's discretion. He was obviously confined to actively short flight and clearances permitting the passage of a clearance authority, as shown in ground to and back of the destination without further clearance.

However, the Flight Information Manual also points out that "clearance" is not to be considered with IFR, and is shown at least than the maximum altitude established by the Administrator . . . for that portion of the route over which the operation was conducted."

The apparently contained in this type of clearance are outlined in Civil Air Regulations 46.407.

The type of clearance issued in this flight was an IFR clearance to cruise at 3,000 feet. An IFR clearance which does not specify "Over-the-top" requires that an airplane shall not descend below the pertinent minimum clearance for the initial approach until wind over the facility has been definitely established. In other words, CAR Part 46.407 applied to the airport clearance.

In this case the maximum no-terrain altitude and the initial approach altitude were the same, 3,000 feet. Therefore the flight had no authority to descend below 3,000 feet prior to arrival over the H facility.

Had the flight been cleared to cruise at a higher altitude, say 10,000 feet, it would have been permissible to let down from 10,000 feet to overfly the station at 3,000 feet on the initial approach. A clearance to maintain 10,000 feet would require that the flight overfly the station at 10,000 feet.

Capt. Gray's proposed letdown from his 3,000-foot cruise altitude may be the dominant factor leading to the accident.

It must be borne in mind that the crash

was 400 feet altitude maintenance in initial approach.

(2) When making an initial approach to a field in instrument conditions, the pilot should not descend below the minimum safe altitude until he has received the clearance to descend below the minimum safe altitude. This clearance should be received from the tower or the airport authority. In the case of a non-towered airport, the pilot should not descend below the minimum safe altitude until he has received the clearance to descend below the minimum safe altitude.

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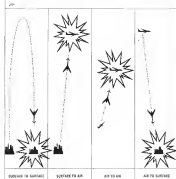
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who was nearly at loss with the energy of intended landing, that the direction of impact was extremely close to the direction of the airport, that the point of impact was only some 700 feet below the top of a hill which was the highest land between airport and airport, only 13 miles ahead, and that the last Berlin warrior gave the flight was close to Berlin maneuvers and becoming worse.

The most probable position of the ADMF indicator, 190 degrees in meridian under the section headed "Inception," is 29 degrees to the left of the aircraft's actual heading at time of impact. Because of more straightforward and subsequent training into a determination of the probable direction, it is believed that the indicator may well have been seen (possibly ahead) in close to it at time of initial impact, thus leading evidence to the probability of a straight ADMF approach.

In substantiating this direct flight from Lutetia truly 75 statute miles it is evident that Capt. Carey stated his descent too early and was attempting a straight approach to the runway, in order to get beneath the current while short of the airport and ahead of the warplane.

His position, about nine miles to the right of course, when starting down through the moment is believed not to be accidental due to wind drift, but planned to facilitate a straight approach.

Since Capt. Carey testified that he had no intention to leave airport on the runway up until a very late moment before entering the runway, it can only be concluded that he knew his present position when starting his landing. Moreover, testimony of the Agency pilot gives a clear time-position picture at the start of this landing.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft crew, and the carrier were completely overloaded.
2. The aircraft was improperly loaded in respect to gross weight and location of its center of gravity.
3. All crew fatalities, both ground and in-flight, were foreseeable.
4. The flight was an instrument class one.
5. The 1814 company weather warning for Berlin reported marginal weather conditions, this was acknowledged.
6. The pilot started his descent too early and with the reported instrument approach procedure for the Berlin, New Hampshire, airport.
7. It is in doing to track a hill while landing down directly toward the airport.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a persistent and unadmitted instrument descent in an altitude that did not permit timely clearance by the Civil Aeronautics Board.

Joseph P. Adams
John Lee
Clara Gurney
Morris D. Deary
(Ken Kelly, Chairman, did not participate in the submission of this report)

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SEARCHLIGHT SECTION

(Continued from page 1)

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Alliantech auxiliary power unit, Model APU-1, for electrical and mechanical operation of guidance and control systems of short-range guided missiles, utilizes solid-propellant gas

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At RCAF stations across Canada, straddling the clock, in the heat of Summer and frigid cold of Winter, civilian course interception exercises with the Avro CF-100 keep RCAF pilots, navigators and ground crews alert against aggression.



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In RCAF operations with Thunderbolt service in Canada, interceptors of CF-100s will begin day with NATO forces in Europe by 1958.



AIR TRANSPORT

Capital Wins East-West Nonstop Routes

CAB gives Northwest Chicago as stop on New York flights, denies scheduled service to North American.

By Gray Lewis

Washington—Capital Airlines has been installed as a full competitor in the keystone New York-Chicago route area by the Civil Aeronautics Board.

In the New York-Chicago service case, CAB has decided to adjust Capital's route structure to make the carrier an effective competitor of American Airlines, Trans World Airlines and United Air Lines in that sector between New York and Chicago.

The Board also added Northwest Airlines to the New York-Chicago run by raising Chicago a point on Northwest's Milwaukee-Detroit-New York route.

In its decision, CAB chose to promote competition by adjusting routes of carriers already operating in the area rather than by inserting new carriers into the route structure as it now stands.

Here are the new routes and services awarded to the case.

Capital

Capital's certificate is extended to permit unrestricted service between New York and Chicago, Detroit, Pittsburgh and Toledo. The carrier also was chosen for competitive service between Philadelphia and Cincinnati and Detroit.

Capital was given a new route segment between New York and Detroit via Rochester and Buffalo.

Northwest

Northwest's transcontinental route was allowed by the addition of Chicago as a point on through flights, subject to a long-haul restriction. NWA will provide a third competitive service between New York and Detroit.

Trans World

Detroit is added to TWA's New York-Chicago route with a long-haul restriction.

An investigation is now scheduled to determine whether weather routes should operate TWA's Detroit-Cincinnati route.

United

United is freed from restrictions against transnational service between Philadelphia and Detroit. The carrier

is also allowed of a restriction from serving New York and, on flights to Detroit or Toledo.

Eastern

Eastern Air Lines' Pittsburgh "closed door" restriction is lifted, permitting I.A.L. to serve passengers to Akron, Cleveland and Detroit on through flights.

The decision was based on the true purpose of promoting competition in the area and strengthening the smaller trunk carrier.

The Board believes that the selection of Capital for the new service "will on the long run contribute most to the development of a second route structure for the sector."

"We believe," CAB said, "that the services we are authorizing for Capital are typical of the kind of service repeatedly suitable for operation by a second carrier and will contribute substantially to the strengthening of Capital's system an objective which is necessary of great importance in perfecting the route structure of the nation."

Restrictions Removed

In addition to strengthening of Capital's route structure, CAB took that selection of a regional carrier offers greater benefits to the public than the granting of an unrestricted or trunk continental carrier, since Capital will be primarily interested in short haul routes involved in the new structure.

The Board notes that Capital has been a leader in the development of aircraft and fleet in selection will stimulate the growth of such service in the area.

CAB removed various restrictions on Capital's certificate. Removed of the restrictions allows Capital to operate weekday and transnational service between New York and Chicago, Toledo, Detroit and Pittsburgh and establishes a fourth route competitive in heavily traveled eastern markets.

Applications Defended

Capital's new Detroit-Buffalo-Rochester-New York route will compete with current Atlantic Airlines service on northern New York State. The carrier of service between New York and New York is deferred for later consideration.

The route adds Philadelphia as a point between New York and Pittsburgh on Route 14 and between New York and Harrisburg on Route 15. Capital is restricted from operating locally between Pittsburgh and Philadelphia pending a later decision on the issue.

Applications for service to Pittsburgh by Capital, Northwest, Eastern, American, TWA and United are deferred for consideration in various other proceedings.

The basic purpose of adding Chicago to Northwest's transcontinental route is to strengthen the carrier's through flight service with the substantial air market available at the Midwest traffic hub. Northwest is currently the only transcontinental carrier which can't tap

North American Turned Down

North American Airlines' charges for certification in route case pending before the Civil Aeronautics Board were denied a recent vote in the New York City Council.

In denying the North American application, CAB said it cannot find the strength necessary "to allow" to comply with the Civil Aeronautics Act and CAB regulations. The Board says its conclusion is based on facts which show that "North American Airlines, Pan American and the other carriers in the North American group have a long history of association with frequent violations of the act and cannot be found sufficiently reliable to warrant with the operation of the certificate." CAB says they proved.

Meanwhile, North American was a vote of the Civil Aeronautics Board was not. Based on the U. S. Circuit Court of Appeals' pending review and final disposition of the Board decision pending the complete set of motions (N.Y. July 14, p. 107). The associated scheduled flight, pending on its challenge of CAB's application in the case issued by the U. S. Attorney General.

The next day news that North American will maintain two positions decided by the Board.

- Using a common ticket agency.
- Using tickets without the operating company's name on the ticket at the first sale.

UAL Predicts 17% Cargo Gain

United Air Lines expects to hold air cargo volume to between \$1.5 to \$1.6 billion in 1975 and freight operating revenue to grow 15% to 17.5 million. For 1976, UAL predicts a higher rate of increase after it receives the Douglas DC-4s, L-1011s and converts two more DC-4s to freight configurations, thus doubling the airline's cargo lift.

The projected increase compared with 14,647,000 freight ton-miles for 1974, 22% higher than 1973's 19,157,000 ton-miles, and revenue totaling \$7,599,000, a gain of 21% over the previous year's \$6,192,800. Despite the decline in passenger income, United's outlook is considerably better than the 11% cut in passenger revenue predicted for U.S. air freight carriers by Robert W. Frost, president of the Henry Type Line (AW Feb 16, p. 7).

"So far so good," comments says E. L. Manglik, assistant manager of cargo sales.

"We plan a service in 1976," United by UAL to develop freight facilities.

• Extension of cargo routes through agreements with Air America World Airways, Aeromexico Airlines Ltd., KLM Royal Dutch Airlines, Qantas Empire Airways, Sabena Airlines and Swissair.

• Plans to build a prototype aircraft at a major freight terminal. A full working of the development with a full conversion, tests, technical limits and on cargo handling testing have to speed off and on loading was tested in Denver last year (AW Nov 29, 1974, p. 50).

• Construction of a San Francisco freight depot that will serve as a prototype for terminals to be built in the future at key cities. The new depot has 1000 sq ft of floor space and temperature-controlled areas for perishable freight.

the Chicago market on its east-west service.

While the decision adds a fifth carrier to the New York-Chicago route, Northwest will benefit easily from service improvements for passengers through faster east of Chicago. The New York-Chicago flights must terminate or originate in New York or in Minneapolis/St. Paul or beyond.

Northwest becomes a major competitor in the New York-Chicago market through removal of through flight restrictions on the route. The Board finds that the New York-Detroit conflict, viewed only to New York-Chicago in this case, supports this restriction on service between American, Capital and Northwest.

TWA Route Improved

A suggested interchange between Northwest and Capital at Chicago is rejected by CAB.

The Board has added Detroit to TWA's Chicago-New York route to replace with a through flight restriction. All flights must be scheduled between New York and Kansas City or beyond. A restriction calling for a stop on flights between Detroit-Los Angeles, San Francisco, Phoenix has been removed.

The addition of Detroit to the TWA route integrates the city into TWA's transcontinental system, an improvement over its position as a terminal on a route with no direct route.

TWA has said it is willing to surrender its Green Bay-Detroit city end route, and the Board has started an investigation to determine whether the route should be transferred to another carrier.

The "closed door" restriction on Eastern's service at Pittsburgh has been suspended. Eastern will be able to carry passengers from Pittsburgh to Akron, Cleveland and Detroit on flights which originate or terminate at Roanoke, Va., or beyond. The new authority is effective until 60 days after Eastern is in compliance with North-west's restriction on Pittsburgh-Cleveland-Detroit service.

Restrictions Lifted

United has two restrictions lifted on the New York-Chicago decision. The carrier will be allowed to operate transcontinental service between Detroit and Philadelphia and can serve Fort Wayne on flights serving Detroit or Toledo.

Applications of Eastern, Braniff Airways, Capital Airlines, National Airlines and North American Airlines for new routes on the area are denied, since the Board has chosen to improve the route structure of carriers already operating there.

While Colorado's route structure is in need of strengthening, CAB questions the public benefits of the service proposed by the carrier since Colorado failed to serve transcontinental routes with DC-4 aircraft.

Airline Disputes

CAB Vice Chairman Joseph P. Adams disagrees with the majority on the issue of service on the New York-Chicago route. He approves the order and service, but in the decision, but he would defer decisions on the applications of National and North American for a case since they have both proposed to offer alternative

coach service. During the year, according to Adams, CAB could issue the results of the present route study in coach development, thus make a final decision.

"The underdevelopment of coach passenger traffic at this time date between New York and Chicago," and Adams "and between these two cities, as far as the coach and the major inter-city routes on the other, of Detroit, Cleveland, Pittsburgh, Buffalo and Philadelphia as to its stand out of the most striking features of the other New York-Chicago proceeding."

"I am convinced that it is of sufficient importance to require us to be the best interests of the more than two million annual air passengers traveling in this area, to take it into account as to see to it that low fare air coach service will be provided either by the existing carriers in the area or by other carriers, the part of which indicates progressively that there is no interest in the low fare air passenger."

INSAC Remote Control To Be Tested Soon

A test for remote control of Intelsat America Communications Stations (INSACS) will be carried out in the Civil Aeronautics Administration station Oct. 3.

The 1966 evaluation program is aimed at determining whether an INSAC can be operated successfully from an adjacent station and the present expansion and increased service, according to CAA Administrator Fred E. Lee.

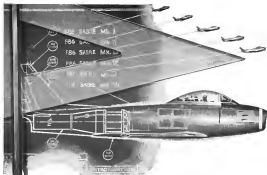
CAA had originally intended to drop operations of INSACS during the year but was prevented from such action by the Senate Appropriations Committee.

In its tests, CAA theoretically will compare the status of an INSACS. This will be done at three sites.

They are the Pointe River, Va., station to be operated from Martinsburg, W. Va.; Green Bay, Wis., and the Fort Belvoir, Wyo., facility, to be remotely controlled from Rock Springs, Wyo. As a result of the tests will be to achieve consensus without impairing the efficiency of INSACS operations.

New Viscount Base

British West Indies Airways is setting up a new maintenance base for Viscount Viscounts at Miami International Airport. The airport's two ports are scheduled to replace passenger Viscounts in November on BWA's route from Miami to Nassau and Jamaica.



Whatever the aircraft ... Development counts at CANADAIR



It was recently announced that the latest Canadair-built P86 Sabre jet fighter can fly faster and climb higher than any other aircraft in European squadron service—practical evidence of Canadair's superior development and production facilities.

This is the sixth version of this famous fighter which has been produced continuously at Canadair without interruption of scheduled delivery dates. The outstanding record of the Orenda-powered Sabre VI can be credited to the intricate re-engineering of the airframe to take full advantage of the aircraft's new power plant—the Canadian Orendo 16.

In this job, as in the work now going on at Canadair to design and produce the CL 28, a maritime reconnaissance version of the Bristol Britannia, the RCAF depends on the imagination and "know-how" of Canadair's engineers. Like so many aviation experts around the world, they know that in every aspect of production, "You can count on Canadair".



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Chief Project Pilots, Tom Lloyd and Fred Hughes, put on the ground, prior to takeoff, following an afternoon air-to-air gunnery check on a fighter command system.

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Bill Tyler, in charge of flight activities at the Center, operates his equipment to the controls of flying test beds. In this Air Arm DC-3 Flying Lab, equipment gives a positive assessment of flyability.



Tom Lloyd, a dual project pilot, talks flyability with project and supervisory engineers. Finding the difference between simulated and actual test conditions is the reason for Air Arm Flight Testing.



A new fire control system is putting this Air Arm subsystem, using the DC-3 Flying Lab in the proving ground. All equipment gets full evaluation under actual flight test conditions.



Complete support to agencies flying test beds is an integral part of Air Arm Maintenance. It is one of the types of service by experienced ground crews using the latest equipment and highly qualified personnel.

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TWA to Fly Cleveland-New York; UAL Gets Nonstop Seattle Route

Civil Aeronautics Board has given Trans World Airlines a Cleveland-New York route and United Air Lines more stop rights from the Pacific Northwest in two cases decided with the New York Chicago Service Case.

A segment of TWA's Route 2 has been extended from Cleveland to New York, as a portion of the proposed Midwestern-Chicago-New York Restriction Case dealing with Cleveland-New York nonstop service.

In the United Restriction Case, CAB has lifted a restriction which usually prohibits nonstop service between Portland-Seattle and Chicago.

Cleveland Service Aided

Both cases have been decided for decisions in conjunction with the New York Chicago proceeding. The decisions are based on findings in the latter case.

The word of the Cleveland-New York segment clarifies Cleveland as a scheduled terminal and integrates the city into TWA's nonstop-scheduled schedule. Flights serving Cleveland and New York must originate or terminate at St. Louis or Detroit.

The new route segment is designed to permit TWA to use modern equipment in its Cleveland service. The basic aim of CAB is to improve service between the Ohio city and beyond Chicago.

United Restriction Removed

TWA's position as a taxpayer air coach promoter is raised by the Board as an additional service advantage for Cleveland. TWA will compete with Northwest and United west of Cleveland and Capital and United to the East. In the United Restriction Case,

CAB decided to permit United to operate nonstop between the Pacific Northwest and eastern points. Conversely, the carrier must make a stop on flights between points in the Pacific Northwest and east of Salt Lake City.

CAB finds that removal of the restriction will result in considerable improvement in service because of the elimination of enroute cruises involved in stopping at a point such as Denver on through flights.

Removal of the restriction is approved by the Board on the basis of sounds made in Northwest Airlines in the New York-Chicago Case. The addition of Chicago to Northwest's East-West Route and the granting of New York-Detroit increased capacity will balance the added competition of United nonstop, CAB stated.

3 Lines to Compete Louisville Nonstop

Nonstop air service between Louisville and New York has been authorized by the Civil Aeronautics Board.

CAB has approved the new service for Eastern Air Lines, American Airlines and Trans World Airlines. All three carriers now fly the route on a restricted basis.

The Board has decided that traffic has developed sufficiently since its 1956 decision on the nonstop issue to warrant lifting of the existing restrictions on the three carriers. Conversely, Eastern must stop at Washington, American must stop at Cincinnati and TWA must stop at either Cincinnati, Dayton or Columbus, Ohio, or at Pittsburgh.



New BOAC Headquarters

New headquarters—long planned and extensive offices of the British Overseas Airways Corp. at London Airport will be completed. Aerials already on the building structure, with a total floor space of over 100,000 sq. ft., is the largest concrete structure of its kind in the world. The headquarters at each end of the building—over 100,000 sq. ft. each—occupies and covers just one side of ground level.

Wright Rule Extended

Civil Aeronautics Board has proposed a five-year extension of the special rules which for provisioned customers take-off weights for service aircraft of 12,500 lb. or less operated by Alaska or carriers in Alaska. The present regulation, 16,175, was adopted two years ago and expires Oct. 31, 1954.

In its notice of proposed rule making, CAB pointed out that a five-year extension of 58,999 was suggested and during its notice of proposed rule making, CAB pointed out that a five-year extension of 58,999 was suggested and during that period it should be determined whether or not such information will be made a part of the Civil Air Regulations. In future comments are to be submitted not later than Oct. 31.

CAB estimates that about 10,000 passengers annually will benefit from the improved service. Louisville-New York traffic increased from 17,000 passengers a year in 1945 to 41,000 in 1954, a 140% increase.

On the issue of who should operate the nonstop service, Eastern submitted that only one carrier should get it, while American and TWA favored authorization of all three.

Eastern told CAB it should have the authorization because it is the power equities in the area and has done more to develop traffic between the two cities than the other two carriers.

In submitting all three carriers to perform the service, the Board said that its duty is to protect the traveling public rather than the private financial interest of any one carrier. CAB points out that most all of the carriers involved have been self-sufficient for many years, there is no longer any need for protection from competition.

PAL May Resume Pacific Flights in '56

Philippine Air Lines probably will resume Pacific flights by mid 1955, more than two years after the carrier dropped all long-range international routes as its resources narrowed (AV April 5, 1954, p. 11). PAL officials are preparing a proposal for the government, legal stockholder in the airline, that will be submitted to the Philippine congress next January. PAL spokesmen are counterparts of service will depend on a government franchise, guaranteed purchase of 513 newly purchased and purchase of new overseas transports.

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Air Transport Assn. to Propose Coordinated Air Education Plan

Airline education programs are increasing on travel volume, helping the American public accept aircraft noise and preparing it for the airlines' transition to jetprop and turbo-prop transport.

To broaden the scope of these programs still further, the Air Transport Assn. is preparing an official proposal for its member carriers.

ATA's project will be designed to supplement the educational services of United Air Lines, Pan American World Airways, Trans World Airlines and Eastern Air Lines and to give other carriers the advantage of a co-ordinated program. It will be submitted to the association's board of directors next December.

The new program will be directed at the administration of schools and colleges, the policy-making group of U.S. education. It probably will be patterned after the annual 10-day Aviation Education Institute started by ATA's Public Relations Department in 1952.

Airline Projects

Educational services of the individual airlines so far have been aimed at the classroom level. Major projects include:

- **United Air Lines.** Started in 1948, UAL's School and College Service Department is a school education program in the U.S. transport industry. Director R. G. Meritt says the department's purpose is two-fold: (1) "to survey constantly the needs of

schools for materials related to aviation education on all levels from kindergarten through college and adult, (2) to meet as far as possible these needs through publication and distribution of educational literature and through personal services."

The amount of material published by United for schools that of any other airline in 1954, the carrier supplied about 1.5 million charts, booklets and pictures to teachers and students. UAL also was represented by exhibitors at 36 teachers' meetings, gave 150 lectures and conducted another 35,000 person and conducted another 25,000 through airport tours.

- **Pan American World Airways.** PAA's service is directed at two objectives: (1) to help students and teachers understand the basic principles of air transportation, (2) assist them in using air travel as a tool for learning and as a means of advancing national and international understanding.

Projects went toward these goals through publication of a large amount of material and through talks before school and civic groups by Education Planning Group members.

The carrier's office also promotes aircraft model building.

- **Texas World Airlines.** Following the objectives of PAA's program and using much the same material, TWA develops primarily on subject of schools and lectures. In the latter program, Texas World leads the field. Educational Director John Farber has

made an oceanic tour and given more than 80 lectures at the United States so far this year.

• **Eastern Air Lines.** EAL is limited to country flights for educational and civic groups and to Business-Industry-Education Day in many cities served by the carrier. The airline does not provide pamphlets or books specifically for schools.

In addition to the major programs, education work on a smaller scale is carried out by Capital, Northeast and Piedmont Airlines.

Educator Support

All of the educational workshops and services are based on the theory that the public will be more tolerant of aircraft noise and other disadvantages of aviation programs if they understand the principles of air transportation.

"The educator is a good man to approach, because he can act and understand the aviation aspect of aircraft," ATA's Charles R. Lombard. "He visits programs similar to those of the airline in schools, clubs and civic groups."

"Most educators already have been headed on the new problems that will come with the transition to jet and turbo-prop aircraft."

Lombard cites the crash of an American Airlines' C-47 at Albany, N. Y., two years ago as an outstanding example of the support offered by teachers and school administrators. "Upon learning of the crash," Lombard says, "I told the education in the area, who had returned after World Aviation Education Institute in Washington, volunteered his services to the airline. He said he would be happy to help alleviate some of the adverse publicity which would undoubtedly result from the accident by explaining to the community, which knew him and which he knew, something about airline operations and the efforts that we made to bring the utmost safety to this flying public."

BOAC Earns Profit Without Comets

British Overseas Airways Corp. reports a net profit of \$712,715 for the fiscal year ended March 31, despite withdrawal of its de Havilland Comet 1 jet transports and substitution of U.S. built passenger liners in shipping equipment.

The net profit, BOAC's third in the past four years, compares with \$1,813,112 for the previous 12-month period. Total operating revenues rose 1.9% to \$169,125,817 from \$167,411,743. Air cargo revenues rose 38.6% to \$2,315,500 from \$1,676,766.18.

Expenses per capacity ton mile increased to 85.6 cents from 87.7 cents, primarily because of previously selling off the 34.7 million Comet development research fees and the cost of acceptance and retraining of new transport pilots withdrawn from service. There also was a direct capital loss of \$4.6 million on BOAC's Comet 1 fleet and equipment and a \$1.1 million deficit on disposal of Boeing transports.

The international airline lost 49 million ton miles, or 11% of the fiscal year's planned output, when Comet service was suspended in April 1954. The annual capacity decline was held to 14.6% with operations of six Boeing 707s from United Air Lines and new from Pan American World Airways, increasing BOAC's fleet to 15. The British carrier also traded over Lockheed 447s Comets to Capital Airlines for seven T-47 Comets.

BOAC has ordered 31 jetprop B-707s from Boeing, 28 de Havilland Comet IVs, 18 Vickers Viscounts and 10 Douglas DC7Cs.

TWA Offers One-Stop West Coast to Europe

Trans World Airlines plans to inaugurate one-stop service between California and Europe Nov. 1.

TWA will operate the new international service with weekly flights from Los Angeles and San Francisco to London and Frankfurt. Both flights will make a stop at New York.

Combination-class Lockheed 1819G Super Constellation will be used.

The configuration will be similar to the four-engine class layout recently proposed for nonstop transcontinental service.

The California-Europe flights have been scheduled for 21 hours and five

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COCKPIT VIEWPOINT

By Capt. R. C. Robson



Echo From ACC

A little more than a year ago (*Aviation Week*, May 17, 1974, p. 111), this column was devoted to a discussion of an traffic-control experiment the CAA planned to conduct at its Technical Development Evaluation Center in Indianapolis. The experiment here was that, while the idea of better control was a noble one, the CAA's plan and method were wrong. A day view was taken of the entire proceedings. For such remarks, I was promptly taken to task by those connected with the program.

The principal point made in this column was that while better technical problems cannot be solved in the hush-halled Indianapolis office a poor job stands for the soul McCoy of the Boston-Nashua service. Further, I mentioned that—since the CAA would have to live with the same dry-dry they sought as well have started their method of living in a laboratory.

CAA Deadline

Well, despite the earlier talking, that is what happened in Washington in July at a meeting of the Air Coordinating Committee as reported by *Aviation Week*, (Feb. 11, p. 112). The CAA was told to Speed Radar Traffic Control. Among other things, the ACC suggested better use of the radar input area to conduct the evaluation. Furthermore, the CAA was given August 1, as the deadline for submission of its plan of action.

This brings us to an interesting point—somehow speculative perhaps—but interesting. Who is it that can "tell" the CAA to get going on a program and make it stick? I was told with the person about airport layout, flight time limitations, navigation aids and other things.

Obviously, someone did the "telling" must have been at the ACC meeting. The CAA wouldn't have told itself, would it? Could it have been the military? No—the government is not supposed to work that way. Then could it have been the chairman of the meeting—Under Secretary of Commerce for Transportation Louis Brandebach? Must have been. And if the point is correct, then three cheers for Mr. Brandebach.

Test Conditions

As I said a year ago, piddling around in Indianapolis is far less than things that will be developing a country-wide system of traffic control. This thing is bigger than any single agency, and it must be done out in the open under actual conditions.

Apparently the ACC recognized all these angles because it directed the CAA to submit full cooperation and coordination with the Department of Defense, Air Navigation Development Board and Launch Labs.

The new attack is more like it. Aviation has probably drifted away from the Common Sense concept of unified effort on its problems. Since the answer belongs to all men and must serve all their purposes, nothing but a single action can possibly suffice.

The thought just occurred that perhaps the "unknown" person might also be able to "tell" someone to get going on landing aids on the ground around—especially the wind-aid. With present lightning, much time is consumed whilst pilots grope for the runway. And of course, we should have more than one instrument runway per airport. Unless better than these are taken care of, a better traffic control system will only be a paper highway to the next bottleneck.

(Editor's Note: *Aviation Week* gives Capt. Robson an opportunity to express himself freely in this column. Comments from readers on his opinions are welcome.)

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One of the most significant military scientific breakthroughs since the atomic bomb has been contributed to the American aviation industry by the National Advisory Committee for Aeronautics discovery and development of the area rule for supersonic aircraft design. The first technically accurate and complete story on this design system on page 15 of this issue, written by David Anderson, assistant associate editor (technical).

The true significance of the NACA area rule lies in its answer to the board application to supersonic aircraft of all types—extremely simple in the critical transonic range and more complex in the truly supersonic area around Mach 2. The so-called "Coke bottle" or "Mach Moreau" fuselage is merely one type of area rule application. Area rule discovery and development were particularly dramatic when they occurred at the very moment that virtually all USAF and Navy fighters aimed at sustained level supersonic flight were apparently doomed to remain just below Mach 1 because the corresponding crop of jet engines available lacked sufficient power to push these designs through the transonic drag rise that then existed in the transonic range between Mach 1.4 and Mach 1.6.

In addition to providing a major scientific breakthrough at the very moment when the technological race with Russia appeared to be becoming hottest, the NACA area rule development also will give military and congressional leaders who are concerned over military security problems an object lesson in how a major military scientific secret can be kept effectively to gain a true advantage over international competitors.

First word that something radically new was being done in supersonic aircraft design first reached Avionics Week in the closing days of 1953. During the early months of 1954 considerable data was accumulated on the "Coke bottle" design, "Mach Moreau" design, and other wing shapes, and the "Whitcomb theory"—all based disagreements for what was actually the area rule. Since all our data pointed to NACA as the source of what appeared to be a revolutionary new concept in supersonic aircraft design we contacted Dr. Hugh L. Dryden, director of NACA, who in addition to his scientific status is a man of integrity. After this conference we wrote Dr. Dryden on April 15, 1954 as follows:

"As a result of your very helpful briefing on the security problems involved in the widespread military application of a new development in high speed aerodynamics we have made a policy decision to inform every member of this in Avionics Week until prototype aircraft embodying this principle are open to public view. This decision was made despite the fact that our reporters unearthed the basic facts on the development and its application from a wide variety of technical sources.

"As you pointed out this is too important a matter with which to tinker. We appreciate your concern in these matters because it helps us to avoid inadvertent disclosures of genuine aeronautical security matters and thus benefits our country."

Dr. Dryden replied on April 20:

"Thank you for your letter of the 15th and the assurance it contained. I think your decision to withhold from public attention the information you have obtained about new developments in aeronautics properly falls in the category of a real public service to the nation."

The real test of the security problem in disclosing the significance of the area rule lies in the fact that there

were several earlier theoretical investigations in this field that had been published in this country and in England without any security classification. Wallace D. Hayes, then of North American Aviation, and two Britons, G. N. Ward of the University of Manchester and W. T. Lord of the Royal Aeronautical Establishment, had all taken a mathematical approach to the problem beginning as early as 1936 but without the research tool of the transonic tunnel available then, they all concluded that there was not much promise to this channel of effort. The real security in the area rule lay not so much in the so-called "Coke bottle" shapes of the fuselage on new fighter prototypes (the Korchman Coke bottle design was well known in the United States, Europe and Russia as a result of captured German documents and hints on resemblance to the area rule) as in the fact that Hayes, Lord and Ward were on the right track in their wing-body relationship studies and that more data could be found in their unclassified publications.

After Avionics Week concluded its security policy on the area rule with NACA, other publications began to get the same information and after talking with NACA agreed to follow the precedent established by Avionics Week. When the Grumman F11F-1 prototype appeared the fuselage indentations were labeled only as a "wing folding" feature which was accurate as far as it went. But on occasion of NACA's area rule as the application of a basic new principle appeared in the American or foreign press.

In September 1954 the editor of Aero Digest isolated that magazine's written commitment to NACA by publishing a fragment of the area rule application to the Grumman Tiger. Avionics Week again coincided with Dr. Dryden on the grounds that if security had been breached we should publish the full story without further security restrictions. Dr. Dryden pointed out that since the published story had appeared in a magazine of limited aeronautical readership it might easily pass unnoticed if it was not picked up and amplified by an aviation magazine well known for its technical accuracy. The missing link to the unclassified data of Hayes, Lord and Ward was still secure as was the scope of the widespread application to new military aircraft.

Avionics Week decided to continue its area rule security policy outlined. We wrote to Dr. Dryden on Oct. 5, 1954:

"After our conversation this morning I contacted Bob Martin our publisher. We agreed unanimously to continue our policy of not printing information on this important aeronautical development until such time as there is a general agreement that its security value has diminished to an extremely low value."

Dr. Dryden replied:

"I believe Avionics Week is performing a valuable public service by its decision to continue its policy of not publishing information on this important aeronautical development until such time as there is general agreement that its security value has diminished to an extremely low value. I realize, at least in part, how sensibly your publication has considered this point in view of the recent publication elsewhere of the information about the development in question."

Now that official military security has been lifted on the NACA area rule Avionics Week has brought its readers the first technically accurate and complete story on this subject and honored its security agreements to the letter.

—Robert Harte



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